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THE PRESERVATION OF CATERPILLARS BY INFLATION.

BY SAMUEL H. SCUDDER.

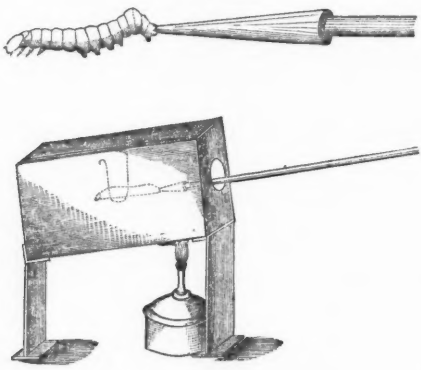
Many persons are deterred from collecting caterpillars, by the difficulty and expense of preserving them in the ordinary way. The easy and inexpensive method of blowing up and mounting the pellicle is so little known in this country, that at the last meeting of the American Association, only one entomologist besides myself had ever seen the operation; since then, others have tried it and been delighted with its simplicity. In the hope of inducing all our entomologists to experiment for themselves, the following explanation of the process has been prepared.

It should be premised that caterpillars may be prepared in this way so as to retain their colors far better than by any other method and often to be fit subjects at any subsequent time for the artist's pencil; the most delicate processes may be preserved uninjured, and the examination of hairy or spiny appendages made even more readily than during life. Specimens taken from spirits, unless absolutely naked, are always difficult to examine from the matting of the hairs; and the internal organs can seldom be studied, even in the rudest manner, unless the greatest care has been bestowed upon their preservation; in fact, no specimen can be fitted by any process, for the study of both internal and external organizations, and for the latter, no method of preparation compares with that of inflation.

The instruments necessary for the operation, besides the tools in the hands of every entomologist, are a small tin oven, a spirit lamp, a pair of finely pointed scissors, a bit of rag, a little fine wire and a straw.

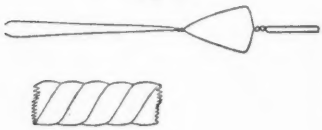
The oven is simply an oblong tin box, about 2½ inches high, 2½ inches wide and 5 inches long; the cover is of glass, and one end

Fig. 76.



of the box is perforated by a circular hole 1¼ inches in diameter. It would be well to have this end of glass, and the opposite end should be movable; the oven rests upon an open standard of twisted wire or riveted tin plates, as in the woodcut (Fig. 76). No soldering should be used upon the oven or standard, as it would soon be melted. Mr. Riley suggests that there would be an advantage in having the front end of the standard higher than the back as he has shown in the sketch. He also proposes a movable wire loop indicated in the woodcut by the dotted line;* but this would seem superfluous.

Fig. 77.



The wire should be very fine and annealed; the best is that wound with green thread and used for artificial flowers. It should

*The engraver should have made this loop hang from the edges of the oven.

not be more than half a millimetre in diameter; the cut represents it magnified nineteen diameters (Fig. 77).

The straw. Mr. Goossens of Paris, my courteous instructor in this art, who possesses a collection of nearly a thousand species of inflated caterpillars, uses nothing but ordinary wheat straw, choosing stout, dry pieces of various sizes, the cross section of which is perfectly circular; with these he inflates the smallest micros and the largest sphingidæ. Various modifications have been suggested; a glass tube drawn to a fine point, and provided with a pair of spring clips to attach to the caterpillar, is a favorite form; the Germans use this largely, and sometimes attach the caterpillar by threads passed around the anal prolegs. Dr. LeConte informs me that Dr. Gemminger uses a finely pointed tube with an elastic bulb attached like a rubber syringe. Mr. Riley suggests (as his drawing represents) still another mode, which is to pierce a piece of soft wood along the grain with a fine heated wire and then sharpen to a point the tube thus formed, to be inserted in the caterpillar; a tube is also inserted in the other end (see Fig. 76). For myself I prefer the simple straw.

The operation. Kill the subject by a drop of ether or by a plunge in spirits; if it be a hairy caterpillar it should remain at least half an hour in alcohol and then rest on bibulous paper for forty-eight hours; otherwise the hairs drop off in the subsequent operation. Then placing the caterpillar in the left hand, so as to expose its hinder extremity beyond the gently closed thumb and first two fingers, enlarge the vent slightly at the lower edge by a vertical cut with the scissors; next lay the larva either upon bibulous paper on the table, or upon soft cotton cloth held in the left hand, and press the extremity of the body with one finger, always with the interposition of cloth or paper, so as to force out any of the contents of the rectum; this process is continued from points successively farther back, a slight additional portion of the contents of the body being gently pressed out with each new movement; throughout all this process, great care should be taken lest the skin should be abraded by too violent pressure, and lest any of the contents of the body soil its exterior or become entangled in the hairs or spines; to avoid the latter, the caterpillar should be frequently removed to a clean part of the cloth or paper. When

a portion of the intestinal tube itself becomes extended it should be seized with a pair of strong forceps, and, the head remaining in the secure hold of the left hand, the tube should be forcibly but steadily torn from its attachments; with this, most of the contents of the body will be withdrawn and a delicate pressure passing from the head toward the tail will reduce the subject to a mere pellicle.

The alcohol lamp is now lighted and placed in position beneath the oven; a straw is selected, of the proper size to enter the enlarged vent, and the tip, after being cut diagonally with sharp scissors, is moistened a little in the mouth (to prevent too great adhesion of the skin to the straw) and carefully introduced into the opening of the caterpillar; the process may be aided by blowing gently through the straw. When the skin is slipped upon all sides of the straw to the distance of nearly a quarter of an inch, without any folding of the skin and so that both the anal prolegs protrude, a delicate pin (Edelston and Williams, No. 19, is best) is passed through the anal plate and the straw.

By this time the oven will be sufficiently heated to commence the drying process, which consists simply in keeping the caterpillar in the oven extended horizontally upon the straw by blowing gently and steadily through the straw, as one uses a blow-pipe. Too forcible inflation will make the caterpillar unsightly by distending unnaturally any spot that may have been weakened or bruised in the previous operation; the caterpillar should be kept slowly but constantly turning, and no harm will result from withdrawing the creature from the oven and allowing it to collapse, to gain breath or rest; only this relaxation should be very brief. The caterpillar should be first introduced into the oven while inflated by the breath, and so placed that the hinder extremity shall be in the hottest part, directly above the flame, for it is essential that the animal should dry from behind forward; yet not altogether, for as soon as the hinder part has begun to stiffen (which can readily be detected by withholding the breath for a second), the portion next in front should receive partial attention and the caterpillar moved backward and forward, round and round over the flame. During this process any tendency of the caterpillar to assume unnatural positions may be corrected—at least in part—by withdrawing it from the oven and manipulating it; during in-

flation, the parts about the head should be the last to dry and should be kept over the flame until a rather forcible touch will not cause it to bend.

To secure the best results it is essential that the oven should not be too hot, the flame should not be more than an inch high and its tip should be one or two inches from the bottom of the oven.

When the skin of the caterpillar will yield at no point, it is ready for mounting. The pin is removed from the straw and the caterpillar skin, which often adheres to the straw, must be gently removed with some delicate, blunt instrument or with the finger nail.

A piece of wire a little more than twice the length of the caterpillar is next cut, and, by means of forceps, bent as in Fig. 77, the tips a little incurved; a little shellac* is placed at the distal extremity of the loop, the wire is held by the forceps just beyond this point, so as to prevent the free ends of the wire from spreading, and they are introduced into the empty body of the caterpillar as far as the forceps will allow; holding the loop and gently opening the forceps, the caterpillar is now pushed over the wire with extreme care, until the hinder extremity has passed half-way over the loop and the shellac has smeared the interior sufficiently to hold the caterpillar in place when dry; the extremities of the parted wires should reach nearly to the head. Nothing remains but to curve the doubled end of the wire tightly around a pin with a pair of strong forceps and to place the specimen, properly labelled, in a place where it can dry thoroughly for two or three days before removal to the cabinet.

For more careful preservation and readier handling Mr. Goossens employs a different method, placing each specimen in a glass tube, like the test tube of the chemist. The wire is first bent in the middle and the bent end inserted in a hole bored in the smaller end of a cork of suitable size, so as nearly to pass through it; the loops are then formed as above; both ends of the cork are varnished, and a label pasted around the portion of the cork which enters the tube, thus guarding both specimen and label from dust, and the latter from loss or misplacement. After two or three days the cork with the caterpillar attached is placed in its corresponding tube and the tube may be freely handled.

* To prepare this, the sheets of dark shellac should be preferred to the light, and dissolved in forty per cent. alcohol.

Modifications of this system will occur to every one. Dr. Gemminger uses a syringe for the extraction of the contents as well as for the inflation of the emptied skin. For an oven, the Vienna entomologists employ an ordinary gas-chimney open at both ends and inserted in a sand bath, which prevents perhaps the danger of too great heat.

NOTES ON THE CYPRINOIDS OF CENTRAL NEW JERSEY.

BY CHARLES C. ABBOTT, M. D.

THE family of fishes known scientifically as the Cyprinidæ, and popularly as "shiners" and "minnows," is well represented in the Delaware river and its tributaries. A careful study of the several species of cyprinoids found in the immediate vicinity of Trenton, N. J., convinces us how difficult it is to define clearly the distinctive characters of many of these fishes, even with a very large number of specimens to guide us; the tendency to vary in color and fin arrangement being especially noticeable. Therefore, while we have ventured to describe, as new to science, a small cyprinoid, collected by us, for the first time, during the season of 1873, we have purposely confined our notes to the species gathered here in large numbers, and not included in several small collections received from other portions of the state. While, therefore, we propose to give the full list of species, found in but a small fraction of the state's territory, we believe it really presents the entire cyprinoidal fauna of the state.

In his admirable synopsis,* Prof. Cope mentions twelve species, of six genera, belonging to the Delaware and its tributaries. The study of the material at our command enables us to recognize, without difficulty, all of these as described and figured in the synopsis referred to; but there is also, it must be mentioned, many specimens that we have considered as species, as defined by Prof. Cope, in which variations exist, that are of sufficient importance, it would seem, to make them even more than marked varieties—

* Synopsis of the Cyprinidæ of Pennsylvania: Transactions of American Philos. Soc., vol. xiii.

varieties that, seen from an evolution standpoint, are well advanced to that point, where the "species" commences and the "variety" ends. To some of these instances, we will call particular attention elsewhere, and remark here that, besides the twelve species given by Cope, there are included four well marked species, of genera not included in the list referred to, being *Hybognathus** Agassiz, *Albernellus* Girard, and *Hyborhynchus* Agassiz, these making the number of genera, nine, that are represented in the Delaware fauna.

So far as our investigations have enabled us to determine, the cyprinoids of the Delaware River, at the head of tide water, and in the neighboring streams, are as follows:—

1. *Semotilus rhotheus* Cope. "Chub." This is our largest and, in the river, our most abundant species. Although the males, in spring, are then most highly colored, they do not become at any season dull or leaden tinted. We have noticed that the variety of tints and general ruddy tinge of the whole fish vary considerably, in different streams; the milky, turbid waters of clay creeks appearing to have the effect of keeping down the rich colors that make this fish so beautiful from March to June, when found in the river or clear spring brooks. Some peculiarities of its coloring fade almost immediately, and others change in hue, on taking the fish from the water. The first published† description of this fish, detailed the colors of a living specimen, which accounts, we suppose, for the difference in the general appearance as given by us, and as noticed by Prof. Cope,‡ when examining dead specimens. The largest specimen we have met with weighed 1 lb. 14 oz.

2. *Semotilus corporalis* (Mitchill). This "chub" is also an inhabitant of several little brooks, sometimes reaching considerable size, but never attaining the dimensions of *S. rhotheus*. As we have often noticed with reference to allied species of fishes, so in this instance; we do not find them *i. e.*, the two species of *Semotilus* associated in small streams, nor intimately so, in the river. Besides the marked difference in color, the smaller scales at once make evident the great difference between this and the preceding; which is much more nearly allied to the northern *Semotilus argenteus* Putnam (*Leucosomus pulchellus* Girard, *et auct.*) "In Gun-

*Synopsis of fishes of North Carolina: Proc. Amer. Philos. Soc., vol. ii, p. 466.
†Proc. Acad. Nat. Sci., Phila., 1861, p. 154. ‡l. c. p. 564.

ther's Catalogue of Fishes," vol. vii, we find a specimen recorded, of *S. rhotheus*, from the Delaware River; and considered the same as *Semotilus argenteus* Putnam. As the specimen is marked "Adult," it seems strange such an error should have occurred.

3. *Rhinichthys nasutus* (Ayres). Both from the limited number of streams, in which it is found, and from the few individuals which occur, this is preëminently our rarest species.

4. *Rhinichthys atronasus* (Mitchill). "Dace." There are but few streams, except in the northern portion of the state, where this pretty species may be found. Generally, we have met with it, associated with the young *Semotilus corporalis*, and both it and the latter were remarkably successful in escaping from a scoop-net, by *burrowing* under stones, with all the ease of a *Melanura* in the soft mud; or else by leaping several inches from the water, and so passing over the rim of the net.

5. *Stilbe Americana* (Linnè). "Roach." DeKay has described as two generically distinct fishes,* under the names of "Variegated Bream" *Abramis versicolor*, and "New York Shiner" *Stilbe chrysoleucas*, the cyprinoid designated above as *Stilbe Americana*. The two varieties, which are not simply varieties in color, are now conceded to be the same species, and it seems strange that DeKay should have considered these variations of more than specific value, when now it is not accorded even that importance. On studying the descriptions and figures above referred to, and instituting a comparison of these with a very large number of specimens of this fish, we have satisfied ourselves that there exists a well marked tendency to vary in this fish, which verges nearly to that line, beyond which a variety becomes technically a species. DeKay's figure, on plate 29, is an excellent representation of the common "roach," as we find it in quiet waters and the larger streams of this state. Color, which properly goes for but little, in the study of the specific differences of fishes, merits more attention in this case, from the fact that there is not any decided deepening of, or variation in, the tints, in the spring or nuptial dress, as compared with that of autumn or winter. In the case of DeKay's description of *Abramis versicolor*, we have a gaudy species described, which suggests at once a fish taken in early spring, when the cyprinoids, as a class, are in brightest colors; such however is not the case with the *Stilbe Americana*, as when we

* Fishes of N. Y., p. 191, pl. 32, fig. 103; p. 204, pl. 29, fig. 91.

examine the figure of *Abramis versicolor*, we find a fish varying in the size and shape of its fins also.

In studying the very large collection of specimens of the "roach," from streams of different character, made during the past summer, we think we have traced a uniform variation in the size and shape of the fins, more especially of the dorsal and ventrals; and with it, a constant difference of the color of the *Stilbes* taken in small, rapidly running streams, and the ordinary "roach" of our mill-ponds and quiet creeks. These differences, in some respects, agree with the distinctions drawn by DeKay between the *Stilbe chrysoleucas* and *Abramis versicolor*, but not in all. Indeed, we have never met with a "roach" that was strictly identical with the fish described by DeKay as a "variegated bream."

The variations we have traced out in a large series, and which we believe to be constant, are as follows:—

Delaware River specimens.	*Shabbaconk Creek specimens.*
Adult, total length,* 7½ in.	Adult (?), total length 5 in.
Dorsal fin, depressed, reaching to the point opposite the 9th ray of anal fin.	Dorsal fin, depressed, reaching to a point opposite the last ray of anal fin.
Ventral fins, depressed, reaching to a point, separated by two scales from the anus.	Ventral fins, depressed, reaching to the anus.
Mouth, when closed, on a line drawn through the pupil.	Mouth more oblique; when closed, the front of the lips on a line with the upper edge of the orbit.
Scales with 7 to 12 radii.	Scales with 4 to 5 radii.
Color as described by DeKay and Storer. Ventral fins crimson on anterior rays, fading into orange. Other fins lemon yellow, with black lines on the dorsal and caudal fins.	Color uniformly blue, with no shade of green or golden; lighter on belly, but scarcely silvery. Fins pale yellow, but at no time crimson or golden.

In order not to mislead the student, it must be clearly understood, that while the specimens of *Stilbe* from the Shabbaconk Creek are uniformly different, as here pointed out, we do find "river" specimens, which are partially grown individuals of the

* In the 4th vol. NATURALIST we have referred to the fact of having gathered many specimens, eight and nine inches long. Compared with the whole number of individuals in any given stream, these measurements are exceptional, and the length above given is about that of the average adult fish.

typical *Stilbe Americana*, that in some respects approach closely to the variety characteristic of the Shabbaconk and other clay creeks. But the variations we have described cannot be ascribed simply to age, especially the uniform blue color of clay creek individuals.

Do we not here have an instance of adaptation to particular localities; even to the change of color? It has often been asserted that we never see a species undergoing a radical change; but is not this an instance of such change, one possibly now of "specific" value, as a "species" was once considered? The color of the waters, in bulk, is bluish; and it has occurred to us that the blue color of these clay-creek roach may have been created or evolved, for their better protection from our ravenous kingfishers (*Ceryle alcyon*), who swallow them without any preliminary carving, as they are said *not to do*,* in other sections of the country. We have noticed, in fact, that this fish is a favorite prey of the kingfisher; and as each species of fish appears to have its own peculiar odor, when alive, we have thought that this fish was through its odor (and flavor?) attractive to this bird; and when inhabiting shallow streams, and so exposed the more to its attacks, how natural to see, in the changed color, a means of protection as an offset, as it were, to its attractions in odor and flavor.

6. *Hypsilepis cornutus* (Mitchill). "Red-fin." Our "red-fin" appears to be in all respects identical with the New England fish, as figured by Dr. Storer.† Young specimens are much less robust than the figure referred to, but the variations we have noticed, in examining a large series, appear to be all due to age.

Besides the deeper coloring and numerous tubercles upon the snout, the males of this species vary from the females in a stouter body and somewhat more elevated dorsal outline; features which are permanent and uniform.

7. *Hypsilepis analostanus* (Girard). "Silver-fin." This beautiful little fish is a constant companion of the preceding species. A partial study of its habits, by means of the aquarium, has demonstrated, however, that it is a more carnivorous fish, and not only were specimens noticed to tear away the fins of each other and of

* NATURALIST for Oct. 1873, p. 634. (Mr. Breed here refers to a note in "Nature" and not the NATURALIST, as printed.)

† Fishes of Mass., p. 118, pl. xxi, fig. 3.

other cyprinoids, but larger ones even killed and devoured adult specimens of *Hybopsis bifrenatus*.

8. *Clinostomus funduloides* Girard. We have, during the past summer, met with single specimens of this last mentioned cyprinoid, associated with other small fishes, on several occasions. They are identical with specimens in the Museum of the Academy of Sciences, at Philadelphia; marked by Prof. Cope, from tributaries of the Susquehanna River, Penn.

9. *Hybopsis bifrenatus* Cope. "Minnow." This little fish, characterized by an imperfect lateral line, and deep straw color and black markings, is probably our most abundant species of this genus.

10. *Hybopsis chalybœus* Cope. "Minnow." This species, which much resembles the preceding, has a complete lateral line. It is not uncommon, and usually met with, associated with the other small *Hybopses*.

11. *Hybopsis procne* Cope. "Minnow." To quote Prof. Cope, "This small species may be readily distinguished among others common in our streams, by its long caudal peduncle and tail, its large brown-edged dorsal scales and plumbeous lateral band."

The first mentioned of these three species of *Hybopsis* is everywhere, in New Jersey, exceedingly abundant, and supplies the carnivorous fishes with an unfailing supply of food. In a collection of *Hybopses* before us, we find the three species represented in the following proportion, and believe this to be about their relative abundance in the Delaware and tributaries, at this point.

Whole number of specimens, 123.

Of *H. bifrenatus*,	. . . . .	75 specimens.
" " *chalabœus*,	. . . . .	22 "
" " *procne*,	. . . . .	26 "

In identifying the above series of small minnows, we have been guided solely by Cope's synopsis, to which we have so frequently referred. While we believe we are correct in our identifications of the three species, we must here mention that there were some individuals of this series (and it holds good of every collection we have made, of small *Hybopses*) which we found it difficult to determine, as to their specific relations, that were in fact neither *bifrenatus* nor *chalybœus*, and, as we believe, not the young of other fishes. In a series of a thousand individuals, one will be

pretty sure of finding intermediate forms, which link these three *Hybopses* very closely. This presence of intermediate forms is not confined, however, to these small minnows. In every large collection of cyprinoids we have yet made, there occurred some individuals, that varied in one or more directions from typical forms, and yet not in such a manner as to indicate probably permanent specific or generic peculiarities.

12. *Hybopsis Hudsonius* (Clinton). "Spawn eater." This interesting cyprinoid is exceedingly abundant in the several tributaries of the Delaware River. The several published figures of the species are characteristic; both those of DeWitt Clinton,* who first described this fish, and that given by DeKay,† are quite accurate, and give the best representations of it we have seen. Prof. Cope's‡ figure of "*Hybopsis Hudsonius*" we believe to be that of the following species, as will appear. At all events, it is a much more marked variety of the true *Hudsonius*, than the small blue *Stilbe* we have described is of the typical *S. Americana*. Of the true *H. Hudsonius*, DeKay writes: "It is called "spawn-eater," from an idea entertained by fishermen that it lives exclusively on the spawn of other fishes." This belief has no doubt arisen from the fact of its having a "sucker"-like habit of feeling carefully over the bottom of the stream with its peculiar "telescopic" mouth extended, and so sucking up such food as it finds to its liking. The examination of the stomachs of many specimens shows that, like the *Stilbe Americana*, it feeds very largely on small mollusca, that cover every stone and other stationary object in the beds of our streams. We do not think the charge of spawn-eating can be laid to this fish with more reason than to all the other cyprinoids. Indeed, without an exception, the ova of all other fishes are, to every species of fish, a luscious morsel; and we are inclined to think that many fish are so far *unnatural* (?) as to devour the newly-laid ova of their own kind.

The very blunt snout, almost at right angles with the forehead, gives this fish an abrupt profile, which, especially when living fish are compared, is a ready method of distinguishing this species from the closely allied *Hybopsis phaënna* Cope, with its more tapered, regular profile.

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* Annals Lyceum of Nat. History of N. Y. Vol. 1, p. 49, pl. 2, fig. 2.

† Fishes of New York, p. 203, pl. xxxiv, fig. 109.

‡ Synopsis of Cyprinidæ of Penn. Pl. xii, fig. 3. (Trans. Am. Phil. Soc., Vol. 13.)

13. *Hybopsis phaënna* Cope. Prof. Cope* has described the cyprinoid here referred to as a distinct form of *Hybopsis*, having received specimens, collected by the writer, in 1864. He says, "*Hybopsis phaënna* is a species, found in some of the tributaries of the Delaware, which I have received from Trenton, N. J., from my friend Charles C. Abbott. It is more elongate in form than *H. Hudsonius* and *H. Storerianus*, and has not the rounded front of the first or small compressed head of the last. Eye a little less than one-third length of head; latter $5\frac{1}{3}$ times to concavity of tail, and more than equal greatest depth of body. . . . . Angle of mouth not posterior to anterior nostril. Scales $\frac{5}{4}$, 38. Lateral line very slightly deflected opposite the dorsal fin. Base of caudal to posterior edge of dorsal, equal from latter to beginning of the skin of the head. D. 1–8; C. 19; V. 1–8; B. 1–9; P. 15; Length 4 inches."

The differences between the two, *H. Hudsonius* and *H. phaënna*, which are quite uniform and readily noticed in living specimens, are as follows:

Hybopsis Hudsonius.	*Hybopsis phaënna.*
Snout blunt. Angular in profile.	Snout tapering. Curved in profile.
Diameter of orbit less than length of snout.	Diameter of orbit more than length of snout.
Anal fin, depressed, reaches to the anus.	Ventral fin, depressed, does not reach the anus.
Bright silvery stripe along the lateral line, golden posteriorly, and uniform olive-green from dorsal stripe to lateral line.	Plumbeous stripe along the lateral line; and four narrow blue lines between the dorsal stripe and lateral line.

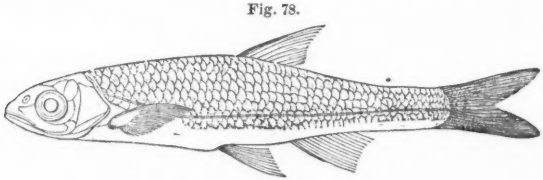
Prof. Cope, in his monograph of Pennsylvania cyprinoids, says "There may still be some question as to the pertinence of this specimen (from the Delaware, at Trenton, N. J.) to *H. Hudsonius*," he having referred it to that species then, and subsequently. Were there no specimens of the cyprinoid found in the Delaware that were precisely such as described by De Witt Clinton, then it might be thought that the *H. phaënna* was simply a modified form of that species; but the two being associated, each preserving the distinctive features, as pointed out by us, with the non-occurrence

* Proc. Acad. Nat. Sci. Philad. 1864, p. 279.

of individuals, that by less pronounced features link the two, leaves little ground for doubting their being really, specifically distinct. It should be remembered, also, that the *H. phaënna* reaches a larger size than the *H. Hudsonius*, here in the Delaware, and the "more conic form" of the snout cannot be ascribed to maturer age, as has been done by Prof. Cope. Specimens three and four inches long are in every respect like Clinton's figure of *H. Hudsonius*, while specimens of *phaënna*, five and five and a half inches long, have the tapering profile, much as in the drawing given by Prof. Cope, and above referred to. In conclusion, we must add that, in the figure given by Clinton, the circular black spot at the base of the caudal is a very marked feature. Cope says in his description, "no spot at base of tail." Now we believe the truth to be, that the *H. phaënna* is also to be recognized by the absence of the caudal spot, which we have never failed to note on typical specimens of the *H. Hudsonius*.

14. *Alburnellus amœnus* Abbott. The discovery of this beautiful cyprinoid makes the second instance of a genus being represented in the Delaware and Ohio rivers, and not in the intermediate river system of the Susquehanna. It was first met with, by the writer, in the summit level of the Delaware and Raritan canal, associated with *Hybopsis Hudsonius*, *H. phaënna*, *Hypsilepis analostanus* and *Hy. cornutus*.

Fig. 78.



Alburnus amœnus. Natural size.

We give the following description of the species with a figure* (Fig. 78). Head shorter and broader than Alburnelli generally; with the profile less pointed anteriorly to the orbit. Orbit large, equal to length of the muzzle, and entering length of head 3·25 times; but a trace less than the interorbital space. Head 4·25 times in length to basis of caudal; greatest depth, four and two-thirds ($4\frac{2}{3}$) times to same.

*The figure was engraved without correction of the drawing on the block and is not accurate in its details.—EDS.

Pharyngeal teeth 1,4—4,1; moderately hooked, and with a narrow masticatory surface, more noticeable on one specimen examined than on the other. The single tooth of the series is in all respects similar to the others, but only half the size. Occasionally the series is 2,4—4,2, as in *Alburnellus rubrifrons* Cope. Anterior ray of dorsal slightly posterior to the insertion of the last rays of ventrals. The anterior ray equals in length the posterior margin (terminal) of the fin. Terminal ray slightly in advance of the anterior ray of anal fin. Anal fin broad, the base equalling the length of the anterior ray. Terminal margin of the fin slightly concave in outline. The pectoral fins terminate at a distance of three scales' width from the insertion of the ventrals. Terminal margin of the ventrals opposite fifth ray of the dorsal.

Lateral line decurved from the upper angle of the opercular apparatus, and continues in a slightly oblique direction to some distance beyond the dorsal fin, and *not rising again opposite that fin and continuing straight to the caudal fin*, as in *Alburnus rubellus* Agassiz. D. 1-8; A. 1-11. Scales 5-39-3. Total length, 3½ inches. Color, pale olive above, with minute black dots on the exposed edges of the scales. A bright silvery band three scales wide at the operculum, and narrowing to a width of one and one-half scales at the base of the caudal fin. Operculum and iris pure silvery. Belly white, but not with a metallic gloss.

The specimens taken were collected late in August, and the colors noted while they were in an aquarium. At present they are rare, both in the river and its several tributaries, and we are confident that we have never seen them previous to last summer, although accustomed carefully to collect and study our various small fishes for the past dozen years; and from the fact of finding it only in the canal, which has an unobstructed outlet into the Raritan River, 25 miles east of the Delaware, it may be that the fish in question is properly a species belonging to that river. It was in this stream that the following species was first met with, in 1870; and now, as will appear, it is a very abundant species in some of the Delaware tributaries; probably derived from the Raritan River, through the communication opened by the canal referred to.

15. *Hybognathus osmerinus* Cope. This very interesting species was discovered by the writer, associated with our common smelt or "frost fish" (*Osmerus viridescens* Mitchill) from the Raritan River, at New Brunswick, N. J. It was first described by Prof.

Cope,* from a specimen we sent him, and has since been figured by the writer.† During the interval, from the time of first detecting this peculiar species until the present summer, we have never met with even a single specimen; the few small fishes supposed to be this species, and referred to by us, in the 4th vol. of the NATURALIST, proving to have been young of other fish, and had we properly studied at the time the anatomy, instead of relying upon the external appearances, such an error would not have occurred. The statement *then* made, however, is *now* correct; for the abundance of this species in some localities is very remarkable.

During the present summer, Prof. A. C. Apgar and the writer fished, with a large seine made of mosquito netting, a pond formed by the united waters of a large spring and the inflowing current of the Delaware and Raritan Canal. To our surprise we found the cyprinoidal fauna to consist wholly of this species, associated with the "roach" and the three small "minnows," *Hybopses*. We procured over one hundred specimens, and from them note the following with respect to their size and appearance. The adult size is probably five inches; the largest specimen taken by us measuring within a small fraction of that length. The orbit, which, both in the drawing given by us, as above referred to, and in that given by Girard of *H. argyritis*, in the tenth vol. Pacific R. R. Survey, is oval, is in the adult living fish, nearly, if not quite circular, and less oval in the young living fish, than represented. After long immersion in spirits, we notice that the eye is oval, rather than circular. Otherwise, externally, we note no variation from Prof. Cope's description. It is given, by Prof. Cope, that the length of the intestinal canal, which is a generic character, is, in *Hybognathus*, four times the length of the fish. On careful measurement of the intestines, in over fifty dissections, we find the length, in *Hybognathus osmerinus*, *to vary with age*, and that it is never less than five and one-quarter times the total length. This is a considerable difference, even in fish measuring only three inches in length. Unlike the fourteen other cyprinoids found in the same streams, the peritoneum in this species is uniformly and intensely black. Examination of the contents of the intestines showed an exclusively vegetable diet, which was indicated by the

* Proc. Amer. Phil. Soc., vol. 11, p. 466 (foot note).
† AMER. NATURALIST, vol. 4, p. 717.

peculiar character of the pharyngeal teeth — without hooks and cultriform — and length of the intestinal canal; it being, as a rule, longer than the total length of the fish, sometimes many times longer, in the herbivorous; and as long, or less than twice as long, in the carnivorous and omnivorous species.

The preferred haunts of this cyprinoid are still waters, with muddy and weed-grown banks and bottom. If undisturbed it lies quietly in the growth along the banks, or in the bed of the stream, and only leaves its hiding place when frightened. It is a sluggish fish, compared with some species, but in the aquarium is active enough, to make it desirable.

16. *Hyborhynchus notatus* (Rafinesque). Among the many hundreds of specimens of our cyprinoids, gathered during the present summer, occurred one solitary individual, that in the aquarium was particularly noticeable for his very blunt snout, small, *inferior* mouth, and the fact of the osseus dorsal ray being separated from the adjoining ray by a membrane. These facts indicated its genus as *Hyborhynchus;* and the length of the alimentary canal, and character of the pharyngeal teeth, showed, on dissection, that the external characters had not been misinterpreted. On careful comparison of this single specimen with Gunther's description* and the figure given by Prof. Cope,† we find that it agrees very nearly with the *Hybor. notatus*, from northern and western rivers. The only differences we could detect were a somewhat larger eye, possibly a more tapering snout, and no trace of a black spot at the base of the tail. Experience in the study of this family of fishes shows that these may all be merely individual differences.

The specimen taken was captured, associated with the foregoing *Hybognathus*, and was placed in the aquarium as such; but the differences were very noticeable when the two species were seen together moving slowly about the plants in the tanks and nibbling at the foliage with their peculiar mouths.

Having completed the list of our cyprinoids, we will, in conclusion, give it a moment's consideration from an evolution standpoint. With no faith in the immutability of specific or generic forms, it at once occurs to us that the list might be properly curtailed by considering as merely "varieties," the *Hybopsis phaënna*, *i. e.*, a variety of *H. Hudsonius;* that possibly the three small

* Catalogue of Fishes, vol. vii, p. 182.
† Penn. Cyprinidæ, pl. xlii, fig. 5.

Hybopses are not as widely different as supposed; and that the *Hybognathus osmerinus* is, in truth, not "specifically" distinct from the allied *argyritis;* that, in fact, it would be more consistent to consider these all, as we did the small blue *Stilbe* of our clay creeks.

If, by a "species," we meant anything other than a convenient arrangement of the various forms of animal life for purposes of study, or saw in the "species" of cyprinoids anything but so many varied forms which natural selection has evolved from some primitive form of omnivorous fresh-water fish, that has given rise to a variety of forms, through a long series of generations, that would, each in its own place and time, suit the particular haunts it chanced to frequent or was forced to occupy; if we have any other thought in view, then, it would be grossly inconsistent to add to the long list of so-called "species." We do not, however, consider "species" otherwise than as here sketched out, and considering also the amount of variation among any considerable number of individuals of any one "species," and believing that varieties are steadily though slowly becoming more and more varied, and so gradually entering what may be termed "specific territory," we claim that no undue use of the imagination will be brought into play, in recalling a primitive, typical cyprinoid, when we range, side by side, adult and young specimens of each of even the sixteen "species," that we have met with so far, in the Delaware River and its tributaries, in central New Jersey.

THE MIGRATION OF BIRDS.

BY T. MARTIN TRIPPE.

THERE is nothing connected with the fascinating study of ornithology that possesses a greater attraction than the migrations of birds. There is so much of the mysterious in their coming and going and we know so little of the manner in which their journeys are performed, that our very ignorance lends an additional charm to the mysterious interest involved. Anemones and buttercups spring up in a day, where yesterday they were not; but ere they come, we might have found the sprouting blades and tender buds

that promised future blossoms as soon as the warm April rains should fall. Like the flowers, the birds come to us suddenly and almost unawares; a day ago there were none; to-day, the woods and fields are vocal with their music; but, unlike the flowers, there was no herald to announce their approach, no presage of their coming. Ere we are aware they are with us; before we know it, they are gone.

On some bright February morning, I go out into brown sere meadows, and wander along the banks of a brook, covered here and there with dense thickets of tall alders and hornbeams, with an undergrowth of blackberries and greenbriars. Yesterday, the only inhabitants they contained were tree-sparrows; to-day they hold a party of red-winged blackbirds, whose harsh merry notes and jolly chatter proclaim their joy at being home again. They have come, perhaps, from reedy marshes that line the Virginia coast; or, perchance, from Carolina rice-fields; but no man saw them on their journey; silently and unannounced, they came and reoccupied their summer haunts. A little later, I visit the same wet meadows, and find them frozen at the depth of a few inches, though on the surface, the black soil is soft and muddy; then comes a heavy rainstorm the next day, and on the succeeding morning, they are alive with snipe. Or, some morning in May, when the woods are beginning to unfold their green robes and the towhee to call from the thickets, I find, here and there, a warbler or two; but only one or two, save, now and then a troop of coronatas. A storm from the south sets in and lasts for a day or two; and when it has ceased, in the morning, I go out into the woods again; and hundreds and thousands of warblers of a dozen species are fluttering through the boughs and copses, and lisping in the tree-tops. How they came, I know not, nor whence; but here they are, where, a day ago, scarce one was to be seen. Two days more and nine-tenths of them are gone.

There are some birds whose migrations are apparent enough. In November we see flocks of robins passing south, high up in the air, calling to each other as they go. In March, and again, late in fall, long trains of crows silently stream across the sky; in September flocks of red-birds wing their way overhead, their presence betrayed by their mellow notes. The ducks, geese and cranes, with much noise and gabble, announce their passage through the country; and in the later days of autumn, the hawks,

distant specks against the sky, are seen floating slowly southward after their departing prey. But the vast majority of birds come and go silently and unawares. No one sees the wren or the sparrow on its migration; no one knows how long they are on the way, or by what route they reach their destination. We know that they come from the south in the spring and return in the fall, and there our knowledge ends.

Most birds move north and south in their migrations; but although this is the general direction of the movement, it is affected more or less by various circumstances. On the seaboard, it follows the general course of the coast, and in the west it is influenced by the border line between the prairies and the forests which, throughout Minnesota and Wisconsin, lies in a northwest and southeast course. Mountain ranges and the interior lakes alter the general north and south direction more or less, and the isothermal lines point out other variations. Some birds appear to follow different routes on the autumnal migration from that which they take on the vernal. The Connecticut warbler, a not uncommon bird in northern New Jersey during fall, is exceedingly rare in spring; while, on the other hand, the Blackburnian warbler is far more abundant in spring than in fall. Other species, again, appear to take a fancy to some particular line of flight, and adhere to it for a number of years, then deserting it for some other. I have known the golden plover, for instance, to be quite abundant in certain localities, for two or three years; and then to disappear almost entirely for a long period. The greater number of vast flocks of wild fowl that sweep up the Mississippi valley every spring, on arriving at the mouth of the Minnesota, sometimes follow up one valley and sometimes the other; one of the two invariably attracting by far the larger proportion, though without any apparent reason.

The regularity which marks the arrival and departure of some birds is quite remarkable. For five successive years, I noticed the first coming of the crow and red-winged blackbirds on the 22nd of February, and so punctual were they, that at last I came to expect them almost as certainly on that day, as though they had been a company of players, announced to appear at a certain time and place. If the weather was unusually stormy or the reverse, their arrival was a day or two later or earlier. Between the 14th and 19th of October, I expected to see the southward flight of the

crows; and very rarely did I fail to notice it within those dates. But other species show the very reverse of this regularity. The snipe and the ducks are notoriously uncertain in their movements, in some seasons coming weeks earlier than in others. The bluebird may be seen, in some years, every winter month; and in others, not one may be found till late in February. The bluebird, however, is a homesick little fellow away from his native orchards, and two or three fine warm days are apt to lure him back, even in the middle of January.

That many birds return, year after year, to the same localities is well established; but it may be doubted if this is the case with all, or even the majority. Spallanyane's experiment is well known; he tied bits of red silk to the legs of several swallows that haunted the house in which he dwelt; and spring after spring, observed the same birds return to their native place. A pair of bluebirds that had taken up their abode in a little bird-house, put up for their especial benefit, returned for several seasons to the same favorite nesting-place—at least I always fancied that I could recognize the same pair—and, as if to obtain undisputed possession of their snug quarters, invariably appeared a few days in advance of the other bluebirds. A pair of night herons took up their residence for three successive seasons, in a little, secluded swamp, where neither before or subsequently, for several years, were they ever seen. Similar instances doubtless occur to every ornithologist.

Of many species the males and females travel together; of some, the former precede the latter; but I know of none where the females migrate in advance of their mates. The robin is a familiar instance of the first case; and probably all the thrushes follow his example. The bluebird, in spring, almost always travels in pairs, except very early in the season when a solitary male sometimes appears. With the *Fringillidæ*, or most of the species, at least, the sexes migrate together. The redstart and some of the warblers appear a little before their less gayly-colored mates; and I suspect that this is the case with nearly all the *Sylvicolidæ*. The bobolink is a conspicuous example of the same nature; on the prairies of Iowa, flocks of hundreds of males may be seen, several days before a single female arrives. The rose-breasted grosbeak is still another instance, and many others might be mentioned. As a general rule when the males are brighter colored than the females, the former

precede the latter; and when there is little or no difference between the plumage of the sexes, both travel together either in flocks or in pairs. In the autumnal migration this distinction is obliterated, and nearly all birds associate together in small parties or large flocks, composed of both sexes; and with many the females and young retire southward, a little in advance of the hardier, adult males.

Few birds are absolutely stationary. Even those that we see throughout the year are migrating to a greater or less extent. The robins that we meet with in midwinter have descended from higher latitudes, while those that passed the summer with us have gone to warmer regions. Specimens of the same species, taken in winter, differ from those of summer in being larger and stouter. The earliest birds that reach any given locality in spring are usually brighter colored and larger than those that breed there, the former passing farther north as the latter arrive. Most birds begin nesting immediately after arriving at their destination, and when, as is the case with the robin, the first comers appear weeks in advance of the breeding season, they remain but a short time, moving slowly northward until they have reached their homes when they at once commence the task of raising their young, shortly after which they begin retiring to the southward. There is thus a constant movement going on, interrupted only by the brief breeding seasons; a general swaying north and south in which one limit is scarcely reached, before a retrogression sets in towards the other; and when, as is frequently the case, the southern limit of the northernmost representatives of a species, is north of the summer range of the southern races, the species is looked upon as resident, although the individuals composing it are strictly migratory. This is the view of J. A. Alllen, as set forth in his interesting "Notes on the Birds of Iowa," and, I believe, corresponds with those of nearly all writers on the subject; but high authorities disagree. Audubon states that the snipe, *Gallinago Wilsonii*, does not appear in Canada and Maine, until nearly three weeks after it arrives on the marshes of New Jersey; while Frank Forester, whose observations in this case are quite as reliable, asserts positively that the snipe appears nearly simultaneously in northern New Jersey, and along the St. Lawrence River as far down as Quebec. The subject has been little studied, and promises most interesting results to a careful investigation; the lack of data

however, is an almost insurmountable difficulty to be encountered at the very outset.

Yet some species remain in the same localities throughout the year. The gallinaceous birds are true residents of the regions in which they raise their young; and many of the *Corvidæ* shift their quarters very slightly, if at all, in any season. Some of the rapacious birds, especially among the owls, are quite stationary; and among the woodpeckers, are species that appear to reside constantly in the same localities. Other species, again, seem to be indifferently migratory or stationary. Of the vast numbers of mallards that frequent the ponds and streams of Texas, during winter, great numbers are said to remain and breed, while the others rove hundreds of miles to the northward.

In the "Natural History of the state of New York"* DeKay gives the Carolina titmouse as being found in southern New York in winter only. If this observation is correct, it affords a unique instance of a bird migrating north in winter; but there is good reason to doubt the accuracy of the statement.

The causes of migration are various; but the principal one is undoubtedly the want of food. Birds seek a milder climate than that of their native regions, because their means of subsistence fail, and they must either obtain it elsewhere, or starve. As soon as the chill of autumn destroys the greater number of insects, and banishes the remainder to their winter retreats, the insectivorous tribes are compelled to migrate to regions where a warmer sun sustains a sufficiency of insect life to supply them with food; and the granivorous species, finding their usual stores of seeds either becoming exhausted or covered with deep snow, follow in their track, while rapacious birds are obliged to accompany their prey. Only the species whose food-supply is unaffected by the inclemency of the season remain. The nuthatch and brown creeper are able to find as ample fare in one season, as in another, and a few sparrows find sufficient food in such scattered weeds as appear above the snow, or amid sheltered nooks and thickets protected from the storm. Even in the coldest weather, wherever the cedar berries are abundant, we find robins, who refuse to leave as long as they can find anything to eat; and bluebirds may be seen amid clumps of sumachs, clinging to their northern homes, until com-

* Possibly, I am mistaken in the reference. If so, the statement is made in Giraud's "Birds of Long Island."

pelled to go by absolute necessity. In wet, springy meadows, and in grass fields, in the eastern states, the meadow lark finds a sufficient supply of food to subsist upon throughout the winter; while on the western prairies, under a less degree of cold he migrates as regularly as the kingbird, being unable to procure the requisite supply of food in his summer habitat. The snipe and the woodcock linger as long as they can find unfrozen marshes and swamps; and in mild seasons, may be found about warm, springy meadows and coppices, sheltered from the frost, even in mid-winter. But were it possible for them to find a sufficiency of worms, and could the warblers obtain such insects as they habitually feed upon, the woods and marshes, instead of being nearly deserted for several months, would remain tenanted throughout the year. Just as soon as the rigor of winter has passed away, and the changed temperature calls forth myriads of gnats and flies to swarm in the woods, and the frozen earth thaws, and permits the worms to approach the surface again, they come back to their native regions from which they had been temporarily driven by stern necessity.

The supply of food, however, is so closely governed by the seasons, that the migrations may be said to depend upon them, although, absolutely speaking, the paramount necessity of subsistence, and not the mere effect of heat and cold upon the birds themselves, is the main cause. Hence, we find, as a rule, that the migrations of those birds, whose food is most affected by a change of temperature, are more regular and extended than those of other species, whose subsistence is more independent of the seasons. The Colopteridæ, Sylvicolidæ, and all insectivorous birds that capture their prey upon the wing, belong to the former class; their range extends, in most cases, many hundred miles north and south, and the migration is complete, few or no individuals lingering behind the rest in their summer abodes. The granivorous species on the other hand, living principally upon seeds, are more stationary, some of them finding a sufficient supply of food in their native haunts, throughout the winter, while the rest migrate southward, though they seldom go as far as the insectivorous birds. The omnivorous species are still more independent; some of them, as the raven, are strictly non-migratory.

Nevertheless, in some cases, mere temperature, unconnected with the question of subsistence, seems to be the motive in moving from one region to another. There is no apparent reason why the

pine grosbeak should not find as abundant a supply of food in the northern forests during cold winters as in mild; yet it is only during the former that it descends to the latitude of New York; while in the latter it does not migrate as far south by one hundred and fifty or two hundred miles. The pine finch, and the crossbills are similar instances. On the other hand, a long, hot summer is apt to entice some southern birds farther north than usual.

Man exercises a very considerable influence upon the migration of some birds. The clearing away of forests, and the planting of trees upon the prairies, attract species that formerly could not find the means of support in those regions; and compel others to shun localities which they were wont to frequent. Fifty or sixty years ago, according to Audubon, the mallard and the wild goose, as well as some other species of water-fowl, bred in considerable numbers in the Mississippi valley; but as the settlement of the country progressed, they retreated farther and farther north, until at the present day, very few raise their young east of the Missouri and Red rivers, or south of the British boundary, although some still nest in central and western Minnesota, and northern Iowa. In this case the necessity of reaching a secure, safe retreat, remote from the settlements, has caused them to extend their migration far beyond its former limit. Doubtless a similar motive has acted in other instances with similar results. The desire to rear their young in quiet and seclusion, is a very strong one in many birds; and if disturbed or annoyed in any way, they will soon abandon the region, and seek another where they can pass the breeding season unmolested.

Violent storms, and sudden changes in the weather, are often preceded by, or accompanied with, extraordinary migration among birds. The immense flocks of pigeons and blackbirds that occasionally pass through the country are familiar to every one. Several years ago I witnessed an unusual migration of the latter bird, which I have never seen equalled, either before or since not even in the coast marshes where they sometimes congregate in enormous flocks. The latter part of February, and first week of March had been very mild and warm, and great numbers of crows, redwinged and cow blackbirds had gone north. There came a sudden, violent storm from the north one night, accompanied by showers of hail, snow and sleet, continuing all next day, and driving before it, immense multitudes of blackbirds. Vast flocks,

flying close to the ground to escape the fury of the blast, passed by so continuously that it was often impossible to tell where one ended and the next began. For four or five hours the immense hosts kept sweeping by; the air at times seemed filled with them; and I was vividly reminded of Audubon's account of the wild pigeons in Kentucky. The storm expended its fury within a few hours after the last blackbird had passed; but although the next few days were clear and warm, not a bird reappeared for nearly a week. A similar migration of white-bellied swallows took place near Newark, New Jersey, some six or seven years since, in the latter part of October, just before a long, northeast rainstorm, followed by sharp frosts. Although their numbers were not equal to those of the blackbirds, the sky at times, seemed fairly covered with their hosts, tens of thousands being in sight at any moment for nearly an hour. Their course was to the southwest; and as if aware of the impending storm, their flight was hurried and direct, far different from their usual circling, easy motion.

But the most remarkable instance of the kind that ever came across my observation occurred in southern Iowa, in the fall of 1871. The weather, at the time, was the perfection of Indian summer,—clear, bright and warm. About the tenth of November, vast numbers of cranes began to fly south. Always a common bird in spring and fall, they appeared in such multitudes, that settlers, who had been in the country for twenty years or more, declared they had never seen anything to equal it. Thousands upon thousands covered the sky at all hours of the day, floating in slow easy circles, far up in the air all moving steadily southward. Most of them were of the sandhill species; but here and there, sweeping in wider circles far above their brown brethren as if conscious of their superior beauty, a flock of white ones appeared,—a beautiful sight, their snowy plumage and black quills sharply outlined against the blue sky; sometimes so high up that they looked like mere white specks, and their loud rattling cries sounded like faint echoes of the whoops of those far beneath them. For three days the remarkable procession lasted; then for the next two days, although the weather continued as warm and clear as it had previously been, not a crane was to be seen; and after that, without the slightest warning, a succession of violent snow, hail and rainstorms set in, followed by intense cold. On the 18th of November the mercury sunk to 5° F., and by the 22nd there

was ice upon the ponds, five inches in thickness. The cranes had not escaped a day too soon.

Many birds prefer to migrate during peculiar conditions of weather. The crows almost always move north against a high March wind. A long rainstorm with heavy winds, in the early part of May, is almost sure to be followed, as soon as it has cleared away, by a great influx of warblers; and I have noticed that the migrating hawks often appear in much greater numbers than usual under the same circumstances. In May, 1865, a long northeast storm, clearing up in the evening of the second day, was followed by an extraordinary flight of hawks. Spending the day in the woods, I was astonished at the number, both of individuals and species. They passed overhead, just above the tree-tops, every moment; sometimes singly, sometimes in pairs, and at times in small parties of five or ten or even twenty or thirty. At a low estimation, I saw a thousand during the morning; and have no doubt that I might have seen ten times as many had I been in the open fields, instead of dense woods. The red-tailed, sharp-shinned, Cooper's and broad-winged species were the most common; but half a dozen other species were observed, including a golden eagle, the only one I ever saw in that locality. All were pursuing the same course—northeast—and all flew at nearly the same elevation, close to the tops of the trees, as if to avoid the strong head-wind as much as possible. Although I had nothing larger than No. 10 with me, such alluring shots were constantly presenting themselves, that I was tempted to fire a score of times or more, without loosening a feather. Had I been supplied with the proper ammunition, I might have secured fifty specimens that day. Other instances are afforded by the hummingbird, who journeys only on the brightest, sunniest days; and the snow bunting, whose predilection for travelling with snow storms, has gained for him, among the Swedes, the name of "bad-weather bird."

But although we may assign many reasons for the migration of birds, there is much about them that is seemingly inexplicable.

It is hard to say, for instance, why the black-throated bunting should delay his coming till May, when his relative, the chipping sparrow arrives a month earlier, and the song sparrow a month or six weeks earlier still; although neither is equipped with stouter bills or forms, or are apparently better adapted to withstand the cold. Or it would be puzzling to tell why Aiken's snowbird, which

remains all winter in certain portions of Colorado finding abundant food, should migrate in spring, while a closely allied species, or variety, the chestnut-backed snowbird, appears just as the former is leaving, and occupies its place. That an insectivorous bird, as the wood pewee, for example, should delay its coming for a month or more after its cousin the phœbe, is explicable by the supposition that the two birds prefer different varieties of insects, and migrate only when they are to be found; but in the case of the granivorous birds, such an explanation is not admissible. It may, perhaps, be merely the force of habit; and such a theory is borne out by the fact that at distant points on the same isothermal lines, the different species do not, by any means, preserve the same order of coming. The water thrush and the towhee arrive two weeks earlier in central Iowa, than they do in northern New Jersey; the yellow-crowned warbler and two or three others on the other hand, are several days later; while most of the birds appear about the same time. But however that may be, whether future migrations will fully and completely reveal all the causes which influence the migrations of birds; or whether many of them are such as to baffle our researches, the subject loses none of its interest because we do not at present fully comprehend it, and must ever remain one of the most engaging studies in natural history.

ON THE STRUCTURE AND CASTING OF THE ANTLERS OF DEER.

BY JOHN DEAN CATON, LL. D.

My investigations of the structure, system of nutriment, mode of growth, cause of death and rejection of the antlers of the *Cervidæ* have led to results which may interest the readers of the NATURALIST.

Notwithstanding Buffon insisted that the deer's antlers were vegetable products, like shrubs, grown upon the animal body, comparative anatomy has long since recognized the fact that they are bone. They are composed of the same constituents as other bones, but with a larger proportion of animal tissue, and as we

shall presently see they are organized in the same way. They are anomalous bones, no doubt, and they differ in their economy from ordinary bone just so far and no farther, than these peculiarities require. They differ from all other bones in being entirely superficial. They are of very rapid growth, speedily mature, die and are soon thrown off, while all other bones are of very slow growth and persistent with the animal through life.

Like all other bones, for their growth and sustenance, they are provided with a *periosteum* with *Haversian canals* and *systems* and *medullary arteries*.

These external bones are grown upon a permanent process of the skull called *pedicels*. The periosteum of the antler, during its growth, together with a black cuticle covering it in which a coat of fine fur is inserted, is called the *velvet*. In this are a great multitude of large arteries which everywhere give off branches, which penetrate the growing antler and convey the blood to the Haversian canals, which are surrounded by, and connected with, Haversian systems, the same as in the long internal bones.

Besides this supply of nutriment from without an internal supply is provided for in two ways. First, a main artery, with a multitude of auxiliaries, passes up through the pedicel into the antler, which answers well to the medullary artery, and secondly a number of large arteries branch off from those of the periosteum at the end of the pedicel, and pass in through the articulation where the transitory unites with the permanent bone. These also pass up into the new-growing antler. Let any one take the first deer's head with horns which he finds in the market, and dissect away the skin at the butt of the antlers, and he will see with the naked eye the canals for these arteries passing into the articulation. The veins are mostly internal.

Thus understanding the system of blood-vessels provided for this external bone, and remembering that the blood-vessels are required to be, as they are, vastly larger than for internal bones, we are now prepared to follow its growth from the beginning to the end.

When the dead antler is cast off, which generally occurs with all but one of our American species in early winter, the blood-vessels of the periosteum reaching the butt of the antler are ruptured and a tolerably copious flow of blood from them ensues. They immediately set to work and extend the periosteum over the end of the

pedicel, filling up the concavity in the top of the pedicel, constituting the seat of the new antler. It remains in this condition till spring arrives, when intense activity is observed in this covering, the temperature of which is greatly increased, and it becomes exceedingly sensitive like any other inflamed part. It is now observed to rise up appearing like a large blood blister, and the rudiments of the fur on the cuticle are observed. It rises up rapidly, forming within itself new systems of blood-vessels till it has attained a height of about twice its diameter, when an osseous deposit is commenced at the circumference of the top of the pedicel. Thus, is commenced the wall of the new antler which is now built up rapidly by new deposits, maintaining about the same distance from the upper end of the column, and very nearly of the full diameter of the perfected antler. As the wall rises it thickens very slowly, the upper extremity presenting a thin serrated edge. At first, the deposit presents the appearance of cancellated tissue, which is first filled up at the circumference and gradually resolved into Haversian canals and systems, which are supplied from the periosteum as before stated. If now we examine a specimen in its full career of new growth, say eight inches long, and one inch in diameter, we shall find the upper two inches a mass of highly inflamed blood-vessels, very sensitive to the touch, while below we can feel the established walls when the periosteum has become quite insensible. Let us dissect it and we find the cavity, large at the upper extremity, gradually narrowing to the lower end of the antler where it may be less than a quarter of an inch in diameter, but this opening does not terminate with the antler. It passes down into the pedicel where it may be a sixteenth of an inch in diameter, constituting the canal for the medullary artery. The whole internal portion of the pedicel is porous, admitting the passage of the other vessels through it into the growing antler above, passing through the cancellated tissue which has formed above till they reach the cavity where they unite with the vascular system, continually forming, as the new growth is extended upward. When a tine is to be thrown off, the beam widens and flattens and the member grows out from the shell, and thus the growth goes on, each progressing, in a proper ratio, so that the tip of each tine and snag is completed about the same time. By this time also the whole interior of the antler is filled with the cancellated tissue, solidified to a good degree towards the surface. The extrem-

ities are first completely solidified. Now occurs a phenomenon which does not occur with the internal bone whose conditions do not require it.

At the extremities first, the deposit of earthy salts goes on till this fills up the canals leading from the periosteum to the Haversian canals, so that the circulation through them is obstructed; and from these points complete condensation goes on till it reaches the lower extremity, when the communication between the external and the internal blood-vessels becomes completely severed. Now it is that the animal is prompted by some natural impulse to rub off this outer covering while yet it is gorged with blood. It comes off in long strips or shreds, which look like red cords suspended from the antlers and cover the animal with blood wherever they can reach and stain the trees and branches which he uses for the purpose. During this time the animal seems excited and even fierce. I *suppose* that this impulse to rub off the velvet arises from an irritation created in this thick vascular covering, from the fact that the arteries are pouring into it their full volume of blood, while the imperfect venous system with which it is provided is unable to return the blood sufficiently now that it is cut off from the veins within the antler which had principally performed that office before the surface canals had been closed.

While this has been progressing on the surface, the growth within has been progressing also from the nutriment received by the internal arteries. The cavities in the branches and the upper portion of the beam pretty soon become hardened, like ivory throughout, and the solid wall on the lower part much thickened. Before the central section has become solid, the nutrient vessels are obstructed below, and the deposit of bony particles is arrested while yet the larger portions of the antler are more or less porous, leaving what may represent the medullary canal, braced in every imaginable direction by thin plates of bone, constituting the walls of the cells, thus leaving the antler lighter, but nearly as strong as if it were entirely solid. The extent of this porous section and its density differ very much in different specimens; still it is present in all, to a greater or less extent. The active internal flow of the blood continues longer in young animals than in old, after the velvet is rubbed off. Sometimes the blood will flow appreciably when the antler is sawed off near its seat, two or three

months after the velvet has been discarded, while in aged animals after that time, the *plasma* principally passes up into the antler.

In the meantime, the lower extremity of the antler, that convex part below the burr, which sits in the concave seat which is the top of the pedicel, has been solidifying much more rapidly than the internal portion above; and before the cells above had become too much filled up, the lower convex extremity, which, during the active growth of the antler, was traversed by the canals of all the internal blood-vessels leading to or from the antler, becomes more and more compact till finally these canals become completely filled up and the circulation above cut off. This lower crust now much resembles the articular bone terminating the internal bones at the articulations. It resembles it in its extreme solidity and larger granules, which any one can see on the roughened surface by inspecting any deer's antler which has been dropped from the living animal, for they are well exposed by the absorbent process to be presently described.

While nature has been doing this work another and a very anomalous work has been progressing in an internal bone.

The pedicel, which during the active growth of the antler was open and porous, allowing the internal blood-vessels to pass through it freely, so soon as the great demand for nutriment had ceased, commenced a new deposit of laminæ in those canals, which before the commencement of that new growth had been enlarged by absorption, until the blood-vessels passing through them are collapsed, and so the circulation through them arrested. This has become necessary in order to furnish a strong firm base for the antler while it is used as a weapon of warfare, which was not required during the growth of the antler, when the pedicel was spongy and weak. This annual destruction and reconstruction of bone tissue nowhere else occurs in the internal animal economy, and nowhere else do exigencies require it.

Now that all sources of nutriment, both external and internal, have been cut off from the antler, it dies and becomes a foreign body on the living animal, and as nature cannot tolerate this for a great length of time she has provided the means for discarding the inert body and presently sets those means in motion. One of the three systems of blood-vessels first described has not yet been destroyed. Those leading from the periosteum into the articulation still penetrate the seam although they cannot penetrate

the solid crust now firmly united to the persistent pedicel. The absorbents of these blood-vessels now commence active operation and undermine the antler. They do not carry away the surface of the bone evenly so as to leave it smooth, but as it were they remove alternate particles, or rather alternate groups of granules, till the union, which before was so firm that no force could break it at the point of junction, has become so weakened that the antler drops off or is detached by some slight violence. This process of absorption requires about one month's time. As before stated the blood now flows freely from the blood-vessels of the periosteum of the pedicel which had penetrated the seam, now ruptured by the removal of the antler. If we now examine the butt of the antler we shall find the surface very rough, like coarse sand-paper, resulting from the unequal absorption before described.

We shall also find it of a most immaculate whiteness without the least trace of blood coming from it, although it is sometimes stained with the blood from below.

Space will not now permit me to pursue the subject and explain the peculiarities of the growth of the antlers on the emasculated buck, and show why it is that they never mature so as to be thrown off, but are persistent through a long course of years, even to the death of the animal.

REVIEWS AND BOOK NOTICES.

YOUNG'S PHYSICAL GEOGRAPHY.*—This is a terse and excellent compilation by one who, as formerly connected with the geological survey of Great Britain and now a teacher of geology, knows how to meet the wants of students. As the preface was written in November, 1873, and the latest information given concerning the results of deep sea dredging and other explorations which have thrown so much light on the geology of the globe, we may feel sure that it contains very late information. The views on the formation of continents and theoretical considerations regarding the geological cause of the present distribution of animals and

* Physical Geography. By John Young, Regius Professor in the University of Glasgow. Putnam's advanced Science Series, New York. 12mo, pp. 368. [1874, no date on title page.] $1.00.

plants are sound. The author insists upon the extreme antiquity of the continents and the fact that the present ocean beds have always been such.

The main drawback in the book is the almost entire absence of illustrations, of which there are not a dozen. The reader, however, is constantly referred to a map. While an excellent book for the British student, the American reader will labor under the disadvantage of reference to the local geology of Scotland and England, to the exclusion of the broader views to be derived from a study of the physical geology of his own continent. Compared with the physical geography of our own Guyot, we miss the elegant diction and broad generalizations of the leading physical geographer of his time. The American "Physical Geography" with its beautiful illustration and maps, which appeal so forcibly to the eye, is a much more valuable aid to the naturalist. Young's, however, is an excellent book to read in connection with Guyot.

HALF HOURS WITH THE MICROSCOPE.*—The issue of "Putnam's Popular Manuals" has furnished us a new edition of this best of books for beginners who take up the microscope as a recreation or as a means of studying general natural history. The new edition includes all the advantages of the first. Something between a catalogue of objects and a treatise upon them, it groups together, in a manner both convenient and sufficiently natural, a large number of fascinating microscopic views. The clear and numerous illustrations by Tuffen West, which are rather constructions of the objects than drawings of any one possible view of them, are not on that account imaginary and faulty as has been claimed, but all the better adapted to their purpose.

With the exception of the considerably and judiciously enlarged introductory chapter on the structure of the microscope by the author, in which the binocular receives such unqualified approval as it deserves and receives from those who use it for similar work, and a good half-hour, by F. Kitton, with polarized light illustrated by a bright chromo-lithograph, this edition is not much modernized nor is it much the worse for remaining as it was originally constructed.

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*Half Hours with the Microscope; being a popular guide to the use of the microscope as a means of amusement and instruction. By Edwin Lankester, M. D. Illustrated from nature, by Tuffen West. New York: G. P. Putnam's sons, 1874.

The appendix by Thos. Ketteringham, on the preparation and mounting of objects, is useful to beginners, though somewhat more in need of revision than the body of the work. — R. H. W.

BOTANY.

Sex in Plants. — The remarks of Dr. John Stockton Hough on sex in plants (p. 19, American Naturalist, 1874) are so kind and complimentary to me, that only a desire to aid science, a desire I am sure my friend will respect, leads me to offer the following remarks.

That Dr. Hough has mistaken my views is clear, from his suggestion that I should have used the word "development" in my papers. Nothing was further from my thoughts. I have endeavored to show that sex is determined before development begins; and I have used the term vitality or vigor in order to express the determining power. In a field so wholly new, as this question was when I entered into it, I had great difficulty in finding terms to represent the facts properly; but whenever I have used the terms vigor or vitality, I have always explained that I meant by them a high or low degree of life whatever that might be. If two plants or parts of plants equally "developed," were placed under the same circumstances as regards nutrition, and one died while the other passed through uninjured, this I call a test of vitality. In the one case there is a low vital power, in the other a higher; this I have taken as the chief factor in deciding sex, and "development" has clearly no place in the idea.

That Dr. Hough has not read my papers very closely also appears from his quotations. It was I and not Mr. Darwin, who recorded the fact that female branches sometimes appeared on male silver maples; and I also gave the account of Mr. Arnold's ross-experiments, both in the "Proceedings of the Academy of Natural Sciences" of Philadelphia, before the dates he refers to. These are minor errors to be sure, but they lead to the fear that there may be greater ones; and that greater ones do occur is clear from his quoting me as saying that, "In Norway spruces it is only in the fourth or fifth year, when vitality in the spur is nearly exhausted, that male flowers abundantly appear." I never said anything of the kind; Norway spruces have no spurs. Again I am made to build considerably on the Cupuliferæ in my arguments

on sex. I have indeed named the oak, the beech, and the hazel, among numerous others incidentally, as plants which would bear out my views; but it is in the Coniferæ, not Cupuliferæ, that I have given in detail the facts.

Any one who will read my papers, as referred to by Dr. Hough, will I am sure not agree with him that they prove his position. His proposition is, "that female plants, like female animals, are less highly developed than males, and are the result of an inferior developmental effort on the part of the female parents." In the first place there can be no comparison between female "plants" and female animals. There is an individualized vitality in the various parts of a "plant," that there is not in an animal, and that vital power which turns food into life is operating in numberless places in the plant, to the one solitary organ in the animal; and in my view it is the varying phases of this vital power as determined by nutrition, in the various and varying parts of plants, which give direction or "development" to the subsequent sex. For instance I have shown that in Pinus, Abies, Picea, Larix, and kindred forms, the female flowers are only borne on those *most favorably situated for perfect nutrition*, and that these many female branches, *after they become half dead*, commence to bear male flowers. How can this favor Dr. Hough's proposition? How can Dr. Hough's proposition be true, if I have truly stated the facts? That they are true I appeal to any one who will take the trouble to examine the trees I have named when in blossom.

I do not think that physiology alone is competent to deal with this sexual question. Morphology must go hand in hand with it. The failures to appreciate this has led my good friend into serious error in his experiments with the corn plant. If he had perceived the common truths of morphology, he would have arrived at just the opposite conclusion to that which he has. "Abridged internodes" are by no means "in other words undeveloped." There is in many plants, and especially in the Indian corn, a tremendous development going on while the "internodes are being abridged. The ear of corn is a complete branch, arrested in its *longitudinal* development. But in its embryonic condition it has more favor than the male. Every blade that forms the "husk" was destined to be a leaf, and every leaf represents a node. Let any one strip the husk from an ear, and in this way he will find that in many cases over a *score of nodes* go to make up the corn-bearing stalk.

Now examine the male branch, with its weak structure and "development," and we find that it exhausted its whole growing force in half a dozen weak nodes, with scarcely the apology for a leaf at any of the nodes. Compare this with the numerous fat husk blades, which are the morphological analogies of the leafy bracts on the male branch, and even Dr. Hough's theory of "development" fails. Then the male panicle is only a female *which has lost the vital power to combine.* If the (usually four) two ranked lower branchlets of the male panicle had the vital power to combine* with an arrested central axis, and the other high vital powers of the female ear also act, we should have an eight rowed ear of corn, instead of a male tassel. "Some of the specimens" appeared, to Dr. Hough, "as if the cob had separated into several segments," because the male tassel had gained more than usual vital force, and came nearly reaching a perfect ear. This, however, is all very clear to those who are familiar with the morphology of the corn plant, but which they may readily be excused for mistaking who have only gone so far as to imagine that "a spike (ear) is only an undeveloped branch, sometimes having two or three internodes it is true, but generally sessile. It answers very well for descriptive botany, but leads to terrible mistakes here.

In regard to Dr. Hough's facts in relation to the sexual changes in the Indian corn, I can bear testimony to their complete accuracy; and I can see that it is only his failure to appreciate their morphological value, and the real bearing of my facts on his own observations, that he has been led to regard them as favoring a view the reverse of mine.

My position is simply this — a male flower and a female flower are essentially the same in their early embryological conditions. Morphology shows that these early identical parts may take either one form (male) or another (female); and I have shown, as I claim, that the physiological law which governs this morphological development, is a higher vital power to turn nutritive forces towards the female than the male transformation — or as I have expressed it in my original paper, "It is the highest types of vitality (not gross development) that take on the female form."— T. MEEHAN.

* To understand how high vital power, and the ability to combine parts, go together see my paper on Adnation in Coniferæ in Chicago vol. of Proc. Amer. Assoc.

A New Ribes. — Among the Ribes collected in Colorado Territory during the past season by Prof. John Wolf, who was acting as botanist to Lieut. Wheeler's Expedition, I find a form which appears distinct enough to have specific rank assigned it. A description is herewith sent.

Ribes Wolfii, sp. n. (*R. sanguineum* Pursh., var. *variegatum* S. Watson, King's Report, vol. v, p. 100). Shrub, neither prickly nor spiny; two to four feet high; somewhat branching; young branches light brown, minutely glandular-pubescent, angled by two slight ridges, continuing down from the expanded base of the petiole above; branches of the previous year ashy-gray with a deciduous epidermis, which, on being shed, reveals a dark brown bark beneath.

Leaves thickish cordate-orbicular, deeply 5-cleft, lobes rather obtuse, unequally serrate (though hardly doubly serrate). Average of largest leaves two, to two and one-half inches in diameter, with sinus at base one-half an inch deep. Leaves slightly viscid; under surface pale green, with a few short glandular hairs; upper surface smoother and deeper green. Petioles from one-half an inch to one and a half inches long, slightly margined by a continuation of the principal veins of the blade; expanded at base, becoming semi-amplexicaul, and *at times* with the expansion strongly pectinately-ciliate and glandular-pubescent.

Peduncles decidedly glandular-pubescent, one to two inches long, including the raceme, loosely 4 to 10-flowered. Bracts ovate-spatulate, obtuse, yellowish-white, verging to red occasionally, one to two lines long, and one line shorter than the pedicels, which are a little longer than the flowers.

Sepals red, lanceolate, one to one and one-half lines long, *never reflexed*.

Petals red, ovate-spatulate, half as long as the sepals and as long as the stamens.

Styles two, recurved, rising conically from the summit of the ovary, red for half their length and parted to, or below, the middle.

Stigmas slightly capitate.

Fruit when young, strongly glandular-hairy, but never prickly, becoming much smoother with age. Mature fruit not pulpy, maroon or reddish purple, globose, three-eighths of an inch in diameter.

Seeds few to many, distinctly margined all around; with the inner covering longitudinally punctate as seen through the gelatinous coating.

Twin Lakes and Mosquito Pass, Colorado Territory. Among rocks, at an altitude of ten to eleven thousand feet.

It will be seen that this plant approaches both *R. glutinosum* Benth., and *R. sanguineum* Pursh. It is distinguished from the former by being fewer flowered, having shorter racemes and a rounder berry; from the latter by its shorter racemes, relatively shorter bracts and longer pedicels, and erect calyx lobes.

Its nearest affinity is (as suggested also by Mr. Watson) *R. sanguineum* Pursh., of which it may be but a variety. I think it sufficiently distinct, however, to bear the name of its zealous discoverer, Prof. John Wolf. — J. T. Rothrock.

Periodic Motions of Leaves and Petals.—These phenomena, on which much has been written both in England and Germany, have been the subject of a fresh series of observations by the German botanist Batalin. He divides the different instances of motion into three groups:

(1.) Rapid automatic motions caused by a special motile organ, the pulvinus, at the base of the leaf-stalk. (2.) Diurnal motions not so rapid but also resulting from a special motile organ. (3.) Diurnal motions belonging to the whole of the leaf-stalk and partially also to the surface of the leaf, but not connected with the presence of a pulvinus. The third of these classes, to which belong the motions of petals which cause the opening and closing of flowers were the special subject of Batalin's observations. The ordinary explanation of the phenomenon has been the different degree of tension in the two sides of the leaf caused by a difference in the amount of water contained in them, which explanation has however already been shown by Pfeffer not to meet all cases. Batalin agrees with Pfeffer's conclusions and he considers the main cause of the motion to be unequal growth of the two sides caused by alternating differences in the light, temperature and turgescence. He believes that the same cause is also one of those most efficient in the other classes of periodic motions connected with special motile organs.— A. W. B.

Ascent of Sap in the Bark of Trees.—M. Faivre has recently performed a series of experiments on the mulberry, hazel-nut and cherry-laurel, which he considers go far to prove the fact that the substances which supply the food of plants have an ascending motion in the bark. For this purpose he made perfect or imperfect annular incisions through the bark, or detached pieces of the bark to which buds were attached, or removed entire cylinders of bark from the trunk. The result of the experiments was that the buds always continued their development when the communication remained uninterrupted with the lower portion of the trunk, while, when this communication was completely destroyed, the buds invariably withered away. If the bud was separated by a perfect annular incision, it withered the more slowly the greater its distance from the incision; and in these cases the starch disappeared completely from the portions of the wood above the incision between it and the bud. When entire cylinders of bark with buds on them were removed, the buds continued to develop, and even produced branches bearing leaves.—A. W. B.

Botrychium lunaria Swartz, in Michigan.—Last summer (August 14, 1873), I found this rare fern on one of the small rocky islands which lie off the southwest end of Isle Royale, Michigan (Lake Superior), which, from its general outline, I have named Triangle Island, it being unnamed hitherto on any of the maps.

This is an important addition to the flora of Michigan; and though I am aware that the plant had already been discovered on Lake Superior, I am assured that this is the first time of its being found within the limits of the United States.

The plants, of which I collected between thirty and forty, grew on the exposed sand-rock, among matted tufts of dwarfed *Potentilla tridentata* Ait., grass, and other plants. They are remarkably fine, well developed specimens, and quite characteristic. The island is not wooded.—Henry Gillman, *Detroit, Michigan.*

Absorption of Ammonia by the Aërial Parts of Plants.—A point of considerable practical importance to agriculturists has been recently investigated in Germany, by M. Adolf Mayer of Wiesbaden, viz., whether the aërial parts of plants have the power of absorbing ammonia or not. He carried out a series of experiments on plants growing in such a manner that access of ammo-

nia through the roots was prevented, while the leaves were subjected to the influence of this substance in either a gaseous or dissolved condition. The upshot of his experiments was that a variety of plants subjected to these conditions all had the power of absorbing carbonate of ammonia by their aërial parts both in the gaseous and the dissolved condition and of employing it in the building up of their tissues. The plants did not appear however to thrive when the access of ammonia through the roots was entirely prevented. The experiments did not indicate that Leguminosæ have any special aptitude for absorbing ammonia through their aërial organs, nor for assimilating the combined nitrogen of the atmosphere.—A. W. B.

ZOOLOGY.

Pet Spiders.—Veritable pets they were, and why not? We hear of pet cats, pet monkeys, pet toads, and an English naturalist had his tame wasp; then why not pet spiders? But without considering why or why not I had them and enjoyed them for several months. The account which I now give of them is written from notes taken several years ago. I did not then nor do I now know the genus to which these spiders belonged, but think they may have been of the genus Lycosa. There were two taken at different times; the first I found under a stone, the second was brought to me pretty thoroughly benumbed with wet and cold, having been taken from a tub of water. I had already provided a domicile for my first capture in the shape of a large cigar box, covered with a pane of glass, and watched with some interest its reception of a new inmate, half expecting it would make an onslaught on the weaker one and kill it for its intrusion, but it manifested no interest whatever, until, enlivened by the warmth, the new comer began to move about, then it was evidently somewhat disturbed and kept to its own side of the box, and the stranger on coming to life enough to realize the presence of its fellow did likewise. Thus for a day or two they were exceedingly shy of each other, but in the course of a week their fear wore away and they were peaceable companions enough, but this amicable arrangement promised to end suddenly, as I thought, at one time, for while I was watching them they ran toward each other; as they met, rising on their hind legs, with the fore legs of each resting on the other's head and body, with jaws widely distended, they appeared as if

about to engage in regular battle, but in a moment they dropped to their feet again and ran away from each other like two kittens at play; this I saw them do many times afterward, always ending in the same manner. I also often saw them chase each other around the box, first one and then the other being the pursuer. I thought then and still think they were at play, for never in any instance did they bite one another, nor manifest an appearance of wanting to do so. The only time I ever saw them exhibit ill temper was when I gave them water to drink, which I did once a day, pouring a small quantity upon the bottom of the box; the spiders always ran quickly to it, and oftentimes would stand with all their feet in the little puddle that I made for them, drinking long and steadily, and sometimes in their eagerness crowding each other; then one would seem to lose his temper and would drive the other away from the water. Another and very neat way I had of supplying them with water was with a piece of whalebone split fine at the end to form a sort of a brush; this would hold a drop or two. I held it near to one of the spiders, but high enough to oblige it to rise on its hind legs almost erect to reach it; this either would do as readily as a dog would have risen to my hand for a piece of meat; after the first two or three times that I supplied them in this way, sustaining themselves by resting the fore legs on the whalebone, sucking the brush dry before letting go of it. After a time I did not need to bring the whalebone near to them. I would merely show it inside the box and there was a run for it, the first one reaching it getting the first drink, the other awaiting its turn; it was a matter of surprise to me that they cared to drink so often and so much. I had supposed spiders were capable of sustaining long fasts, both in eating and drinking; in fact the experience of others teaches us that such is the case, but in this instance they were ready to drink at least once a day.

I supplied them well with flies for food and closely watched their method of taking them. The motion of a cat creeping upon a bird is as good an illustration as any of the method; the spider would creep to within the distance of an inch of the fly, stand perfectly still a moment and then throw the body forward as far as the length of the hind legs would admit, the hind feet not moving from the place on which they were fixed, preparatory to the spring. They did not often miss in the first effort, but, if they did, they made repeated attempts until the fly was captured,

and after eating it they would set about cleaning themselves, a matter in which they were very precise, commencing with the legs first to clean the body, and afterwards the legs with the jaws and palpi; commencing with the first right leg, then washing the first left, next the second right and so on until all were clean, depositing the accumulated dirt in a minute heap in front of them, pushing it away with the fore legs when they were done. On one occasion I put a common house spider in the box with them, thinking that they would kill and eat it as they were much larger than the new spider, but instead of attacking it they seemed much alarmed and kept as far from it as possible. Thinking they would pluck up courage during the day I did not remove it; at night I found that the house spider had spun a web covering the most of the box, and my pets were stowed away in a corner completely cowed. I removed the house spider, tore out his web and they soon recovered their spirits and were as lively as ever.

I divided the box in which they were confined filling half to the top at one end with soft loam, thinking they would dig a hole in which to conceal themselves when so inclined, but they did not, though I saw evidence several times of their digging; in one instance the soil being excavated to some depth, but irregularly, having no appearance of the smooth round hole that we find in the fields dug by this or an allied species. I supplied a paper tube of suitable diameter and about three inches long, and this they both used, though rarely both at the same time; in only one or two instances did I find them both in it.—HENRY L. MOODY.

REPRODUCTION OF A FISH'S TAIL.—In Lyell's "Principles of Geology,"* occurs the following sentence: "The pectoral and tail fins of many fresh water fish, having been cut off, have been perfectly restored in about six weeks' time." As this statement embodies a fact with which many naturalists seem to be unacquainted, I am glad to be able to give it a new confirmation.

In the rooms of the Boston Young Men's Christian Union there is a fine aquarium, well stocked with gold and other fish. Early in the spring of 1873, the well known fish fungus (*Achlya prolifera?*) made its appearance in the tank, and several fine fishes died. Among the specimens attacked by the fungus was a young gold-fish, which by some unknown means had lost its tail fin. The

*Tenth London Edition, vol. ii, p. 478.

fungus came out all over the stump of the tail, the fish became sick, and was apparently dying. At the time I knew nothing of the nature of the destructive fungus, but having my attention called to the case, I at once concluded that I had to deal with some parasite, and resolved to try to exterminate it. The only caustic available happened to be strong nitric acid, a few drops of which I applied to the affected tail stump, allowing it to remain a moment or two, after which I rinsed it off in clean water, and restored the fish to the tank. Of course the parasite was killed; the patches of fungus sloughed off, and the sick fish soon became well and healthy. A few days later I thought I saw more of the fungus appearing upon the previously affected part; but, upon looking more closely, found that the appearance was really due to the growth of new rays. In the course of a month a new tail fin, perhaps a fourth of an inch long, had appeared, which continued to grow rapidly, so that in three months from the time of my experiment the fish could not be distinguished from others in the aquarium. The lost tail was reproduced with absolute perfection, the reproduction taking place not only under my own eyes, but also under the observation of several competent witnesses.

This case seems to me interesting as a confirmation of what was already known, and also as showing that the reproduction of the lost part was not prevented even by the application of one of the most powerful and destructive of all caustics. — F. W. Clark.

The Kinglets in New Jersey. — We are somewhat surprised to find it stated in the latest work on North American ornithology* that the two kinglets (*Regulus satrapa* and *R. calendula*) are not *known* to breed in the United States, but that a few are *believed* to remain throughout the summer in Maine, "and probably breed in the dense *Thuja* swamps." Both of these kinglets are quite abundant in New Jersey from early autumn until late in spring, as is well known; and we have twice stated (Geology of New Jersey, 1868, p. 769, and volume iv of this Journal), that a few individuals remain, during the breeding season, among the mountains of Sussex county of this state. Both there and in the adjacent territory of Monroe and Pike counties, separated from Sussex county by the Delaware River, here a narrow stream, the kinglets,

*A History of North American Birds by Messrs. Baird, Brewer and Ridgway. Land Birds. Vol. i, p. 73–76, Boston, 1874.

in scanty numbers, unquestionably do remain throughout the summer months. As I knew of their presence in June, July and August, I presumed they bred there, very naturally (*both* the presumption and the breeding). In the summer of 1871, I had an opportunity of examining a number of warbler and other small bird skins, and among them were two unmistakable skins of *Regulus calendula*. These skins were marked "Laurel (*Rhododendron*) swamps, Monroe county, Penn., July 11, 1871."

What indeed is more likely than that these birds, which are so abundant during autumn, winter and early spring, should occasionally remain as far south as New Jersey, especially when we consider that the northern portion of the state, and the adjacent counties of Pennsylvania, are all so admirably adapted to their wants and likings? Especially is this true of Monroe and Pike counties in Pennsylvania, where there are almost impenetrable rhododendron jungles and hemlock swamps. Throughout summer, these wild by-ways are always cool and damp, just as a locality some miles to the south, which has already been described in the NATURALIST (vol. ii, p. 39) by T. C. Porter, who says of it, here "the ice accumulates in immense masses during the winter and lies undisturbed until late in the spring." It was here that Prof. Porter sought northern plants and was rewarded "by the discovery of *Sedum Rhodiola* DC.— an inhabitant of high latitudes in Europe and America." Have we not here a precisely similar instance in botany, to that, in ornithology, of the presence of our two kinglets, during the summer months? With our migratory birds the geography alone does not decide all their movements — the geology too has its influence; and this is notably the case with reference to the movements of the countless thousands of warblers that follow the valley of the Delaware on their northward migration in spring; and also with those semi-arctic species that, visiting us in winter, are checked on their return sojourn, as summer approaches, by the dense, damp forests of the Delaware valley, where winter long seems to linger in the air, just as in April, in the hollows of the woods, the unsunned snow is still lingering when the fields and open glades are bright with violets, Epigæa and the columbine. —CHARLES C. ABBOTT, M.D., *Trenton, New Jersey, Feb.* 18, 1874.

THE HONEY-ANTS.— It is but a few years since this animal was described by Westmael, under the name of *Myrmecocystus Mexi-*

canus. What is known of it is still imperfect, and a prolonged study would elucidate many interesting facts.

I first saw this animal last summer in Santa Fé, but it was not till late in the fall that I had occasion to examine its habitation.

A structure like a crater about one inch in diameter indicates where they live underground; they make no hills like other ants. A narrow canal of the diameter of a quill leads several feet deep, it is variously contorted and sometimes widened out to a chamber; in such chambers or cavities are seen stored up five, six and more honey-ants serving as a larder for the others that are not honey producing, the latter performing the other household duties; they are very small and of a yellow color.

The opinion that the honey is discharged into receptacles is entirely erroneous; the only receptacle is their own abdomen swollen up to the size of a pea, clear, transparent; the intestines even being recognized as a narrow canal winding through the rounded and puffed-up abdomen. The strain on the membrane is such as almost to cause it to burst. Many do burst, for on digging up the habitation very carefully, one can often notice specks of the soil entirely saturated with liquid honey, and near by the collapsed ant. In many cases the rupture produces death, and the non-producing ants are seen around such places enjoying the sweet liquor.

The honey has an agreeable taste, slightly acid in summer from a trace of formic acid, but perfectly neutral in autumn and winter; it contains a little more water than the honey of bees, and has therefore somewhat greater limpidity. The Mexicans press the animals, and use the gathered honey at their meals; others prepare by fermentation an alcoholic liquor from it.

It would be worth while for beekeepers to try to introduce them into some kind of bee-hive fitted with a suitable dry soil and the proper food at hand for them.

The average weight of a non-producing ant is two milligrammes, that of a full honey-ant two hundred and forty milligrammes, a contrast simply immense.—Dr. Oscar Loew, *Chemist and Mineralogist to Lt. Wheeler's Exploring Expedition.*

Spizella Breweri (?) in Massachusetts.—M. W. Stone brought me a ♂ sparrow shot December 15, 1873, in Watertown, Mass. It was in company with *S. monticola*. I could not identify it with

the aid of any of the books I had at hand, and so sent it to H. W. Henshaw, who kindly compared it with the series of *S. Breweri* he took in Arizona, now in the Smithsonian. He replies in substance as follows:— "Though hardly typical *Breweri* it is strikingly that species — at any rate can be identified with no other. The peculiarities may result from a modification by climatic influences, or may be merely individual abnormality. The whole upper parts, but particularly the crown, are almost exactly as in *Breweri* proper (no trace of chestnut on crown); the same is the case regarding relative lengths of wing and tail, the latter being longer than the former in *Breweri* (wing 2·40, tail 2·60 in *Breweri*) wing 2·52, tail 2·63 in this specimen. In *S. socialis* these proportions are reversed. The bill is strikingly diminutive, smaller than in any *Spizella* I ever saw. The bill and feet are darker than in *Breweri*, while a strong ashy suffusion of the under parts, which also to less degree tinges the whole plumage, are points of dissimilarity from the characteristic flaxen or gray-colored shades of *Breweri*, and an approach to *socialis*." — WILLIAM BREWSTER, *Cambridge, Mass.*

[NOTE. — Dr. Coues, on reading the above, says that he carefully examined the specimen while it was in Mr. Henshaw's hands, and agrees that it cannot be distinguished specifically from *Breweri*, though it has some points about it indicating *socialis*, suggesting a possible hybrid of the two. — EDS.]

THE CHIMNEY SWIFT; CHANGE IN PLACE OF NESTING. — I see by the NATURALIST of December, 1873, that Mr. J. H. Sears, of Beverly, Mass., has noticed *Chætura pelasgia* to forsake the old chimney and build its nest in a barn in company with the barn swallows (*Hirundo horreorum*). A similar instance came under my observation a few years ago. A pair of chimney swifts selected the *end* of a barn *inside*, and there, about three feet below the vertex of the roof, built and reared their young for several years. This was in Lewis Co., N. Y. As this country became settled, these birds deserted the hollow trees of the forest and took up their abode in our chimneys. But here they find, after sad years of experience, that during every heavy rain (unless the mouth of the chimney is very small) numbers of their nests are washed away. And now we see that some of them, at least, have come to the wise conclusion that they are "never too old to learn"

and have acted accordingly. Is not this a good example of the influence of civilization and domestication upon the habits of birds, and can it all be attributed to *instinct?*—C. HART MERRIAM.

THE MYRIOPOD CERMATIA POISONOUS. — Day before yesterday, a lady in this house stepped on a *Cermatia forceps* when she was barefoot. It was evening and dark. She thought at first that she had trodden on a carpet tack, but it seemed quite different soon, more like the effects of a coal of fire.

She lighted the gas, and saw the large Cermatia which bit her. It was wounded by her tread and had its revenge. It bit just between the toes and her foot swelled a good deal, and pained her so much that she consulted me. But it yielded to an application of ammonia and camphor.

The swelling and pain continued about thirty-six hours, keeping her awake most of one night. — JOSIAH CURTIS, M. D., *Washington, D. C.*

BLIND CRUSTACEA. — A new and interesting genus of Decapod Crustacea has been described by Mr. Wood-Mason (in the Proceedings of the Asiatic Society of Bengal, August, 1872) which was dredged in deep water off the eastern coast of the Andaman Islands, and which is closely allied to the northern European *Nephrops Norvegicus*, but, like *Calocaris MacAndreæ* of Bell, is destitute of the organs of vision. — Prof. WESTWOOD'S *Address before the Entomological Society of London.*

BIRDS AND CATERPILLARS. — In the very timely article from Dr. Packard in the May NATURALIST, Mr. C. J. Maynard is reported as stating, that no bird but the Baltimore oriole will feed on the tent caterpillar. Last season I noticed that the black-billed cuckoo fairly exterminated this pest in an orchard near the college, though the tents existed in great numbers. Both the robin and blue-jay will eat the larvæ of the *Dryocampa senataria*, and in eating them have done great service to our state. — A. J. COOK, *Agricultural College, Lansing, Mich.*

A SINISTRAL HELIX ALBOLABRIS. — While collecting land shells with Mr. Anson Allen of Orono, Maine, we found a sinistral shell of the *Helix albolabris* with the animal still alive in it, but as the lip had not been turned, Mr. Allen took it home and kept it till the lip was fully turned. — C. H. FERNALD.

NOTE ON PRESERVING INSECTS IN COLLECTIONS.—I have devised a method for preserving insects without the trouble of camphor. No Psocus, nor *Cheyletus eruditus*, nor other pest dares enter a box after I have treated it. Having a clean-papered box I wash it with common carbolic acid (disinfecting solution) with two-thirds water. It dries without any stain, and I find, after many months' trial, a perfect result. Sheets of card thus medicated give me all the small, soft Hemiptera, etc., with antennæ, etc., not eaten by Psocus, as was formerly the case.—T. A. MARSHALL, *in Entomologist's Monthly Magazine.*

GEOLOGY.

DEEP SEA EXPLORATIONS (Report Brit. Assoc. in Athenæum for Sept. 27).—The largest audience of the week was gathered together on Tuesday morning (the final sitting), to hear Commander J. E. Davis discourse "On the recent Achievements of the Challenger Deep-sea Expedition." Capt. Davis confined himself to the proceedings of the Challenger Expedition north of the equator, which formed a natural section of the voyage. The operations with which he chiefly dealt were the deep-sea soundings viewed in their relations to physical geography rather than to zoology, which, as is well known, occupies a large portion of the attention of the scientific staff of the Expedition. He described and exhibited to the meeting the various mechanical contrivances adopted to sound the greatest depths with accuracy, ascertain the temperatures, and bring up mineral and zoological specimens from the bottom. In the course of the voyage outward from the Thames to Gibraltar, and thence to Madeira and the Canaries, the first interesting set of soundings were taken off the entrance to the Straits of Gibraltar. The soundings over a large area in this section are as follows: just beyond the meridian of Cape St. Vincent, due west of the straits, 2,500, 2,125, and 2,250 fathoms; and, again, between Madeira and the Canaries 2,350, 2,400, 2,200, and 1,975 fathoms; but westward and northward, outside this area, the depths diminish to 1,525, 1,400, 1,550, and 1,650 fathoms. These results seem to indicate the existence of another deep basin outside the Mediterranean, circumscribed by a ridge similar to the two deep basins within that sea. Great depths were found close up to the islands of the Madeira and Canaries group, but a much

more abrupt elevation from the sea-bed was presented in Bermuda. The deepest sounding yet made in the ocean was at a point eighty miles distant from these islands, where a depth of 3,875 fathoms was found. Five miles of rope was run out with the sounding apparatus, taking one hour and twelve minutes in its course. The other soundings taken around Bermuda prove it to be a peak, formed by coral animals, rising abruptly from the abysmal depth of 1,500 to 1,820 fathoms — comparable, as Dr. Carpenter observed, to the Matterhorn. Between the West Indies (St. Thomas) and the Canaries, nearly in the middle of the Atlantic, shallower depths were found, showing that a submarine ridge here exists. The depths over the ridge are 1,900 and 1,950 fathoms, whilst on either side of it a broad basin extends, deepening to 2,650 fathoms in the western basin, and 3,150 fathoms in the eastern. In crossing from Bermuda to the latitude of New York, especial attention was directed to the Gulf-Stream, both as to the depth and temperature of the current. A sounding of 2,425 fathoms was obtained just within the southern edge of the famous stream. From serial temperatures taken at various depths in the stream, it was found that in this part of its course the warm water does not extend beyond 100 fathoms in depth. It was found to be 57 miles broad, rapid only along the western edge, where there was a belt of water 15 miles wide, running 3½ to 4 miles an hour, and 3° Fahr. higher in temperature than the other parts of the stream.—*American Journal of Science.*

ANTHROPOLOGY.

A Human Skeleton from the Diluvium.—M. Riviére who discovered the famous human skeleton at Mentone in 1872 has recently (March, 1873) exhumed another in the cavern of Baouné Roussée at Venti Niglia near Mentone in the South of France. The cavern is twenty-seven or twenty-eight metres above the level of the sea and about twelve metres deep. The ground is covered by a layer of red conglomerate about a metre in thickness. Beneath this layer are large blocks of stone which appeared to be piled up about the entrance and among these blocks were found the first traces of a human dwelling. Round about were scattered bones of the genera Cervus and Capra mixed with shells of Patella and Mytilus and a few stone and bone implements. At a depth of three and three-fourths metres below this upper habitation was

found a second with numerous animal remains, the age of which did not admit of a doubt, and among them a human skeleton. The most important among the animal remains were bones of the hyæna, horse, marmot, *Ursus spelæus*, *Bos primigenius* and various species of deer, but none of the reindeer; also numerous remains of birds, and of land and marine mollusks. The weapons and instruments were made partly of bone, partly of stone, and belong in no case to the period of polished stone implements, but to the oldest stone age; some of the smaller instruments were made of quartzite or felsite. The human skeleton was not in so good a state of preservation as the other previously discovered; it lay extended on its back near the entrance to the cavern, the ground round it being covered with a stratified deposit of ashes, charcoal, fragments of bone, teeth of animals, mussel shells and stone implements. The height of the skeleton must have been, when perfect, as much as two metres or a little over, *i. e.* about six feet, six inches. M. Riviére refers without hesitation both the skeletons found near Mentone to the older stone age, about the end of the epoch of the cave-bear and *Rhinoceros tichorhinus*.—A. W. B.

MICROSCOPY.

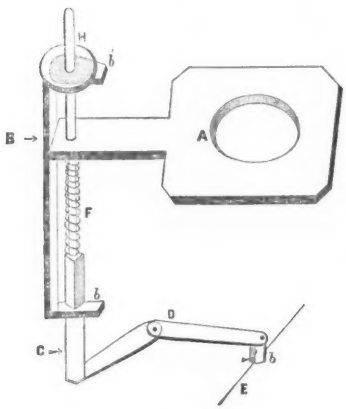
Arranging Diatomaceæ.—The convenience of having diatomaceæ arranged for observation is appreciated by all who make a study of this attractive branch of microscopic research.

The first requisite is a mechanical finger which may be had very cheaply after the following pattern:—A plate *A* (Fig. 79) is attached to the body of the microscope by the objective of from 1 inch to $\frac{2}{3}$ inch. To this plate is attached the part *B* perpendicular to *A;* this has the projections *b* and *b'* through which works the sliding shaft *C*, the lower part of which is square fitting accurately in the projection *b*. The shaft, the upper part of which is furnished with a screw-thread, is raised by turning the milled head *H*, the spiral spring *F* moving it downward. The arms *D* are attached to the shaft and to these the needle holder *d* in which the needle is placed at an angle of about 45°. This finger can be used with nicety with a little practice, and can be made by any one that has a little mechanical ability. I have made one that did not cost over 25 cents for the materials.

The other requirement is a stage plate to carry the thin glass cover. It should be about $1\frac{1}{2}\times4\frac{1}{2}$ inches, upon which is made to

revolve a turntable represented by Fig. 80. *A* is the plate, *B* the turntable, the use of which in locating the object is apparent, *C*

Fig. 79.

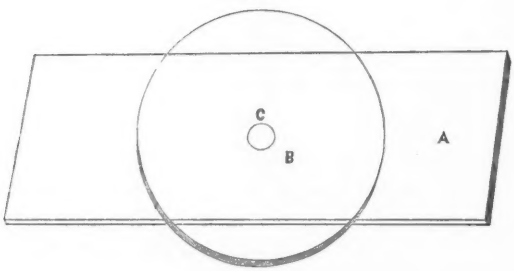


an aperture about $\frac{1}{4}$ inch in diameter for the transmission of light to the cover on which the arrangement is being made.

The cover should be coated by a very thin film of the purest gelatine dissolved in distilled water.

The process is now easily consummated. The cleaned diatoms

Fig. 80.



being evenly spread upon a glass slip and the slip placed upon the stage, select the specimen desired, let the sliding shaft down

by turning the milled screw till the point of the needle (which should be very fine, or a bristle may be used if preferred) touches the object, give it a few backward turns to lift it clear, then more rapidly by means of the coarse adjustment of the microscope; substitute the stage plate with the cover attached to it by some kind of cement and carry the plate, by means of stage movement, so that the object may be let down in the required position on the glass cover. Another may then be placed beside it, etc. After completing the arrangement, moisten the glue by breathing upon it or holding in the vapor of distilled water, though the latter is liable to wash the objects out of place unless dextrously managed. They are then secure and will sometimes bear rough usage in mounting without becoming displaced. Occasionally there will be a specimen that will adhere to the needle so persistently that we are liable to consider patience no longer a virtue. In such cases try another specimen, as different diatoms of the same species vary greatly in grade of difficulty. My experience is that discoid forms are most easily arranged and the light Naviculæ the most difficult. Sometimes air prevents the balsam from entering the frustule, which may be avoided by separating the valves of such as will admit of it, when time is of no consideration.

Thus any one of the requisite mechanical tastes can have slides of diatomaceæ arranged in squares or otherwise to suit the fancy, and a large number of specimens be examined without change of slides. The finest specimens may be thus secured, from impure gatherings, and reference made to any particular specimen without the use of the "finder."—W. W. Riner, *Greene, Iowa.*

Histology.—Dr. James Tyson's magazine article, narrating his experience in the laboratories of Dr. Klein of London and of Prof. Stricker of Vienna, has been raised to a little book and published by Lippincott as an Introduction to Practical Histology. The additions to the original article are not extensive, but are designed to make it more comprehensive and more available as a hand-book for actual beginners in histology. While almost every microscopical treatise is full of mounted objects and mounting objects, it is refreshing to find even a small work which says hardly a word about either, but devotes itself entirely to microscopical study. Like most histologists, the author values highly the vertical use of the microscope, and says little of the binocular instrument.

He believes the "vegetable spores" of Salisbury and the "elementary corpuscles" of Zimmermann are fragments of the larger colorless blood corpuscles. For embedding tissues preparatory to cutting sections of them, he pins them into the centre of little boxes extemporized out of white paper, and pours the melted embedding material around them; seeming to prefer for this purpose the medium suggested by Dr. J. G. Hunt, which consists of common transparent soap cut into small pieces and melted in a water-bath with the aid of alcohol, this being a cleanly and transparent material which can be kept in a bottle and easily melted (by placing the bottle in warm water) and poured out when necessary. The only serious mistake in the book is the measurement of the image, in estimating magnifying power, at the distance of the stage instead of at ten inches; an erroneous procedure repeatedly pointed out by us in other cases, and in this case beautifully illustrated by the direction on the same page to measure it, when using the camera lucida, at the distance of ten inches, which of course would give the same results in exactly those instruments whose stage happened to be ten inches from the observer's eye. On the whole, beginners in histology should thank Dr. Tyson for a neat, handy, and timely work whose usefulness is far in advance of its size.

Morphology of the Saprolegniei.—This doubtful family, that seems now finally deposited in the algæ, has now considerable economic interest from the destructive effects produced upon fish eggs in the hatching trays, supposed to be caused by *Achlya prolifera*. The following summary is translated from advance sheets of "Contributions to the morphology and systematic relations of the Saprolegniei;" by N. Pringsheim. (Jahrbuch für wissenschaftlicher Botanik, ix, Bd. 2tr. Heft.)

The results of my investigations on the Saprolegniei may be condensed as follows:

1. In all the Saprolegniei the male organs of generation develop from the well known antheridia, that are formed near, or grow toward the oogonia.

2. Those in which antheridia or their equivalents are wanting, are not, as has been supposed, distinct species, with modified organs, but parthenogenetic forms, whose sporangia ripen and bud without fertilization.

3. In the Saprolegniei there is but one kind of sporangia; those which develop parthenogenetically, and those which are fertilized are identical, and show no difference originally. The unfertilized zoospores grow sooner and more readily than those which are fertilized.

4. Several peculiarities in the formation of zoospores, which have been considered sufficient specific distinctions, are not important as such, but are merely evidences of a greater or less tendency to dimorphism, representing various stages of development in the zoospores.

5. Also various sexual forms of growth may appear in the same species, which are not reliable as specific distinctions.—W. H. S.

Section Cutters.—At the Queckett Club, Mr. T. C. White alluded to the impracticable expensiveness of many excellent section cutters, and stated that he had used with great success a contrivance, which consisted of a brass tube fastened at right angles with a brass plate, upon which a glass plate with a corresponding aperture was cemented for a cutting surface. The substance to be cut was embedded in an inner tube which was simply pressed up by the finger when required.

Mr. Walter White read a paper on the "Science-Gossip" section cutter in which the plug holding the object is raised by slight blows upon a wedge, instead of by a screw.

The President, Dr. R. Braithwaite, said that he did not possess a section machine, but was accustomed to cut sections of sphagnum and other leaves by inserting them in a slip of soft cork and cutting them by hand.

Lecture-illustrations of Microscopic Objects.—Rev. W. H. Dallinger has communicated to the Royal Microscopical Society an improved method of preparing transparencies for use with the lime-light and lantern. He finds large drawings unsatisfactory for a large audience, as well as incomplete in detail, unless prepared with great labor and skill, and the usual transparencies for screen use, whether photographed or painted, cost too much time and labor to be always available. To obviate these difficulties, he draws the magnified image on a surface of finely ground glass of the size of a magic-lantern slide. The drawing is as easily done as upon card, using a black lead pencil, and the camera lucida if

necessary. Colors may be added, if desired, by a sable-hair pencil. The surface is then protected, and the drawing instantly changed into a transparency, by flowing thin balsam over it and allowing it to dry as a thin film over the surface. In the same manner illustrations of subjects not microscopical may be easily and rapidly prepared.

Podura Scales.—A happy accident has furnished Mr. F. H. Wenham a supply of specimens that seem to confirm the theory he so strongly defends of the reality of the spines on this most disputed of "tests." A favorite specimen which contained a detached spine having been destroyed, and an effort to remove uninjured the large scales which adhered to the broken cover-glass having failed, he scraped off the scales at random with a sharp knife edge and mounted the fragments, and was pleased to find many of the fragments cut obliquely in such manner as to leave the spines (!) cut at a different plane and manifestly projecting beyond the other portions. Mr. Wenham's drawings certainly seem to confirm his descriptions, and photographs of the same appearances are promised.

Lengthened Immersion Tube.—Mr. E. Richards, of the Royal Microscopical Society, renders the familiar immersion arrangement available in deep water, eight to ten inches, by screwing in an adapter between the objective and the nose piece of the microscope. This carries the objective with its immersion cap down through the stage and into a tank of water beneath it.

Automatic Turn-table.—Dr. F. B. Kimball prefers this arrangement to the usual method of turning by hand. He uses the works of a common clock, putting a pin through the shaft of the table and cutting a slot in the hand arbor of the clock-work, and then mounting the turn-table so that the pin will catch in the slot and the two move together.

Origin of Blood Corpuscles.—Dr. H. D. Schmidt, of New Orleans, has communicated an elaborate study of this subject to the Royal Microscopical Society. His studies were chiefly directed to human embryos of six weeks old, and upward. He is convinced that the nucleus only, of the colorless blood-corpuscles, is developed into the red corpuscle. He strongly confirms the prevalent opinion that the spleen and lymphatic glands are the perma-

nent blood-formative organs. He looks upon the blood corpuscle as a gland-cell destined to promote within itself the transformation, into other elements, of certain materials derived from the liquor sanguinis, and when matured to give back directly "to the liquor sanguinis, by its final dissolution, its secretion, consisting of its own body."

Substitute for the Camera lucida.—Mr. W. Kesteven, Jr., substitutes the thinnest possible cover-glass for the tint-glass commonly used for camera lucida purposes. He does not appear to suffer from the difficulty of too great transparency which has deterred others from its use.

NOTES.

Two months ago, in announcing the provision made by the Legislature of Kentucky for a geological survey, we asked whether the time were not coming for a careful geological and zoological survey of Massachusetts. Since then, active measures have been taken to secure this result. The American Academy of Arts and Sciences (the oldest and highest scientific body in the state) has petitioned the Legislature, and a memorial, referred at first to the Committee on Education, has now been placed in the hands of the Board of Education with instructions to investigate the matter and report at the assembling of the next legislature. The memorial of the Academy, before its adoption, was thoroughly considered by a special committee, consisting of the President (Hon. Charles Francis Adams) Professors William B. Rogers and T. Sterry Hunt, and Messrs. George B. Emerson, Alex. Agassiz, S. H. Scudder and R. H. Dana, Jr., so that we can have no doubt of a favorable report from the Board of Education.

The publications of such a survey, says the Academy, in its memorial, should embrace a detailed topographical map, on a scale of about an inch to a mile, maps colored to show the distribution of rock-formations and economic minerals, with charts on a larger scale of particular localities, having special interest or importance; sections and explanatory text to accompany these maps, embracing descriptions and analyses of the rocks and ores and of the waters, and investigations into the strength and durability of our building-stones; full descriptions and truthful illustrations of the animals and plants, including their natural history, transformations and relations to man and his requirements.

The memorial goes on to show that in carrying out the survey the State could take advantage of the provision made by Congress, by which any State undertaking a topographical survey of its territory is empowered to call upon the United States Coast Survey to make the preliminary triangulations, so that the State is at once relieved of a very important part of the work to be done. In making these triangulations, the Coast Survey utilizes the experience of local professors and their students; and in the same way, it would be entirely feasible, in following the trigonometrical with the topographical survey, to employ the services, in different parts of the State, of the same persons. The survey would thus become at once a most valuable auxiliary to scientific education, by giving the younger men in our schools of science and technology an opportunity to put their studies to practical use.

The Academy places in a conspicuous light the educational advantages which would accrue from such an undertaking and urges that the reports under the proposed survey should, as far as possible, be prepared with special reference to an intelligent use by the people; and that, instead of being distributed gratuitously, they should be sold through the ordinary agencies at a slight advance upon the cost, so as to enable the State to pay the authors from the proceeds of the sales, and to recover the greater part of its original outlay, without placing the books beyond the reach of persons of moderate means. Such a mode of publication would unquestionably be the most economical for the State, and the most certain to bring the books directly and naturally into the hands of those who would value and use them.

These suggestions are timely and important, and if faithfully followed, would reduce by one-half the ordinary expenses of such a survey. One or two further suggestions, however, are needed; that the Legislature should at the start ensure the continuance of the survey for a term of years, ten or fifteen at least; and that the appointments should be removed from the domain of politics or of personal preferment. Why should not the nominating power be intrusted to such a body as the American Academy? This measure would give confidence in the success of the survey.

We bespeak from our Massachusetts readers all the aid they can render in this matter. If the movement fail now, it may be years before we can hope to see it urged again with the least chance of

success. Educational institutions and associations should bear their testimony to its importance, and every one interested in the cause of education, every lover of nature should make this a matter of public notoriety and public interest, and obtain for it the hearty coöperation of members of the coming Legislature. We shall revert again to this topic and keep our readers acquainted with any new development.

Necessity of a Common Language in Natural Science. "It may be asked why I, in my catalogue of arachnological literature, have not included any other works than those written in Latin or in the living languages of Teutonic or Roman origin. The reason is, not that I undervalue what may have been written in other languages (which I am very far from doing), but simply that I am unable to understand even the titles of works written in, for example, Russian, Polish, Bohemian, Finnish, or Magyar; and thus I have only by accident come to learn that a couple of works in these languages treat on arachnological subjects.

"It may in general be taken for granted that a person of liberal education has some acquaintance with Latin, and knows at least one Teutonic and one Romanic language; and when this is the case, he can, without any great waste of time, learn so much of the others as to be able, with the help of a grammar and a dictionary, to understand the purely descriptive works within his own department that are written in those languages. This is probably the reason why, in determining questions of priority, it is customary to attribute as much importance to works written in, for instance, Portuguese or Swedish as to those written in any of the more generally studied languages. But it is, of course, impossible to assign the same weight to *all* languages. No naturalist can have time to acquire the knowledge of all the *European* languages which have already a scientific literature to show; and the languages of this part of the world will assuredly not long continue to keep exclusive possession of that territory. It would seem, therefore, to be absolutely necessary, even for the future, in the selection of the works of which a zoologist or botanist ought to be expected to possess a knowledge, and which, in the determination of questions of priority, ought to be taken into account, to confine one's self to those which are written in the living languages of Teutonic or Roman origin and in Latin.

"The want of a *common* scientific language will unquestionably become gradually more and more felt; and as a return to Latin can hardly be expected, it is not improbable that *English* may sometime or other acquire that rank, not only because that language is far more widely diffused over every part of the earth than any other culture-language, and that already two of the greatest nations publish in it the results of their scientific labors, but because English, on account of its simple grammar and as combining in nearly the same degree Teutonic and Romanic elements, is by most Europeans more easily acquired than any other language."—*Remarks on Synonymes of European Spiders*, 1873, p. 583 (a work written entirely in elegant idiomatic English).—By Prof. T. THORELL, of Upsala.—*Annals and Mag. Nat. History.*

We may add that De Candolle, the Swiss botanist, has lately advocated the use of the English language as a common scientific language, and in this connection we quote the remarks of Mr. G. O. Sars, the well known zoologist of Norway, in the introduction to his elaborate work on animal life at great depths off the Norwegian coast.

"That I have chosen a foreign language instead of my mother tongue, as the medium of this communication, is a circumstance which I think does not call for any justification on my part. Science is cosmopolitan, and therefore requires a generally intelligible language. Our language has not reached this point yet; and to facilitate the reading of this little work, I have adopted one of the great universal languages. I have preferred the English language, as well because it has most affinity with our own, and consequently affords greater facility for rendering the Norwegian expressions, as in acknowledgment of the great progress which zoological science has made in recent times, through the medium of the English languages."

THE present indications are that the meeting of the American Association for the Advancement of Science, at Hartford, in August, will be one of unusual interest and will be largely attended. The citizens of Hartford have commenced the work of making arrangements for the meeting with great enthusiasm, and the well-known liberality and wealth of the city make it certain that the local arrangements will be made as perfect as possible. As favorable to the success of the meeting we notice a new feature in the local sub-committees, that of the appointment of a number of ladies as a Committee of Reception. The circular of the Per-

manent Secretary of the Association has been issued, and that of the Local Committee will soon follow. When the latter is published we shall give a summary of the local arrangements. The circular of the Permanent Secretary, as well as the necessary blanks for the entry of papers to be read at the meeting, and for application for membership, can be obtained by addressing him. There are hundreds of persons in the country who, though deeply interested in its object, are not yet members of the Association. Many would join the Association and aid in its work if they were more fully acquainted with its rules and character, and such we recommend to apply to the Permanent Secretary for further information. Among the business matters to be attended to at the meeting, will be the acceptance of the Act of Incorporation giving a legal existence to the Association; while the new Constitution proposed at Portland will be acted upon. We learn that the Portland volume of Proceedings is nearly printed, and that it will contain many of the most important papers read at the meeting. A number of members whose papers were accepted for publication have not sent in their manuscripts, notwithstanding the very long time allowed them to do so. We also learn that the Committee on the donation by Mrs. Thompson have accepted and commenced printing a monograph on "Fossil Butterflies," by Mr. Scudder. This work, which will be an exhaustive treatise on the subject, fully illustrated, and of quarto size, will form the first of the special memoirs of the Association, and in every way will be worthy of the liberal patroness. The following are the officers elected for the Hartford meeting which will open on August 12th: —*President*, Dr. J. L. Le Conte, of Philadelphia, Pa.; *Vice President*, Prof. C. S. Lyman, of New Haven, Conn.; *Permanent Secretary*, Mr. F. W. Putnam, of Salem, Mass.; *General Secretary*, Dr. A. C. Hamlin, of Bangor, Me.; *Treasurer*, Mr. William S. Vaux, of Philadelphia, Pa. *Standing Committee*, *ex officio*, Ex President, Prof. Joseph Lovering, of Cambridge, Mass.; Ex Vice President, Mr. A. H. Worthen, of Springfield, Ill.; Ex General Secretary, Prof. C. A. White, of Brunswick, Me.; President, Vice President, Permanent Secretary, General Secretary and Treasurer of the Hartford meeting. *Local Committee:—Chairman*, Hon. H. C. Robinson; *Vice Chairmen*, Prof. John Brocklesby, J. M. Allen, Esq.; *Secretary*, Rev. W. L. Gage; *Treasurer*, Geo. P. Bissell, Esq., and one hundred and one other citizens.

THE FRENCH ASSOCIATION for the Advancement of Science.—We copy the following from an extended notice in "Nature," as showing the high stand the French Association has taken, and the cordial support it has received, and also as containing suggestions that the American Association might, with proper modifications, follow to great advantage:—

"The first volume of the yet young French Society's Proceedings does it infinite credit. It is a handsome, beautifully printed volume of 1,330 pages, containing upwards of 200 papers, addresses and lectures on a wide variety of subjects, connected with science, pure or applied. The volume is also well illustrated, some of the plates appended being coloured, a feature which we think the British Association would do well to imitate in its 'Proceedings.'

The French Association, as our readers no doubt know, made a very auspicious start, the number of members amounting to somewhere about 800. There are two classes of members—1st, *membres fondateurs*, who subscribe one or more shares of the capital of the Association, a share amounting to 500 francs; there are about 250 members of this class, some of whom have subscribed several shares, among the latter being a considerable number of railway and other public companies; 2nd, ordinary members, paying an annual subscription of 20 francs, or a life-subscription of 200 francs; the names of about 50 life-members are in this volume. After an existence of scarcely three months, the Association possessed a capital of nearly 140,000 francs, and an annual revenue of more than 16,000 francs.

The French Association is modelled pretty closely after the older British one, its aim being, according to the rules, 'to promote by every means in its power the progress and diffusion of the sciences from the double point of view of the perfection of pure theory and of the development of their practical applications.' These ends it proposes to accomplish by means of meetings, lectures, publications, and donations of instruments or money to persons engaged in scientific researches. It appeals for help to all those 'who believe that the cultivation of science is necessary to the greatness and the prosperity of the country.'

The Association is divided into four groups, and each group into several sections; the groups are—1. The Mathematical Sciences; 2. Physical and Chemical Sciences; 3. Natural Sciences; 4. Economic Sciences. The French Association devotes more attention to the practical application of scientific principles than does the British one; the 1st group, for example, including Sections of Navigation and of Civil and Military Engineering: the 3d group including the Medical Sciences, and the 4th group Agriculture."

A SOCIETY has lately been organized in Detroit, Michigan, designated the Detroit Scientific Association, and having for its object the advancement of scientific knowledge in all its branches. At a meeting held on April 16, 1874, the regular election of officers for the ensuing term took place, with the following result: *President*, Dr. Geo. P. Andrews; 1st *Vice President*, E. C. Skinner; 2d *Vice President*, Prof. J. M. B. Sill; *Cor. Secretary*, Dr. A. B. Lyons; *Recorder and Cabinet Keeper*, E. Wolfenden; *Treasurer*, C. C. Cadman; *Librarian*, J. C. Holmes; *Curators*, D. Farrand Henry, Fredrick Stearns, Henry Gillman.

Commencing with a list of over thirty charter members, and with promises of large accessions to the number, the society bids fair to become one of the prominent institutions of usefulness in this city.

After adjournment the newly elected curators held a meeting with a view to make the necessary arrangements for procuring suitable rooms for the Association as soon as possible, a large number of specimens, books, etc., having already been offered for the museum and library.

ARCHÆOLOGY will be well attended to in northern Europe this year. The "Congress of Archæology and Prehistoric Anthropology" will meet in Stockholm on August 7th, and will continue in session for nine or ten days. The government has asked from the Diet, a grant of 20,000 fr. towards defraying the expenses of the meeting. A magnificent palace has been set apart for the holding of the Congress, and the King and the city will each give grand fêtes. Visitors will be carried over the railroads at half fares, and many excursions will be made. The "Congrès d' archéologie slave" will be held at Kiew from Aug. 14th to Sept 3d. As "Nature" states, the students of prehistoric man will have a good time of it in northern Europe this summer.

THE entomologists and chemists will probably muster in large force at Hartford, in connection with the meeting of the American Association. At the Portland meeting a memorial was presented by the entomologists and endorsed by the Standing Committee, urging the American and Canadian Entomological Societies, to hold annual meetings at the same time and place with the American Association, and they also appointed a committee to bring before the Hartford meeting for discussion, a code of rules

for securing uniformity of nomenclature among American Entomologists. The chemists are proposing the celebration of the Centennial of Chemistry and the indications are that the celebration will take place at Hartford, during the week of the Association meeting, though this is not yet officially determined.

SINCE the publication of our note about the Anderson School of Natural History in the May number, we have learned that in addition to the instructors there named, Dr. W. S. Barnard will give lectures on the Protozoa, Prof. D. S. Jordan will take charge of the department of Marine Botany, and Mr. P. Roetter will give instruction in drawing.

BOOKS RECEIVED.

Memoires de l' Academie Royale de Copenhague. Vol. x, no. 3, 1873. 4to.

Bidrag til Kundskat om Arterne af Slægten Cyamus Latr. eller Hvallusene. Af Chr. Fr. Lutken. Med 4 Tavler.

No. 4. Almindelige Egenskaber ved Systemer af plane Kurver, med Anvendelse til Bestemmelse af Karakteristikerne i de elementære Systemer af fjerde Orden. Med 5 Tavler. Af H. G. Zeuthen. 1873.

No. 5. *Thermochemiske Undersogelser.* XII. *Undersogelser over Iltnings og Reductionsmidler.* Ved Julius Thomsen. 1873.

No. 6. *En Sætning om den Eulerske Faktor svarende til Differentialligningen* $M+N\frac{dy}{dx}=0$, *hvor M og N ere algebraiske Funktioner af x og y.* Af P. C. V. Hansen, 1873.

Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College. 4to.

No. VII. *Revision of the Echini.* Part iv. By A. Agassiz. Cambridge, 1874. With plates.

No. VIII. *Echini, Crinoids and Corals.* By Alexander Agassiz and L. F. de Pourtales. Cambridge, 1874. With plates.

Bulletin of the Essex Institute. 8vo. Vol. vi, Nos. 1 and 2. Jan. and Feb., 1874. Salem.

Elemente des Ersten Cometen Vom Jahre 1830, mit Berucksichtigung von 319 Beobachtungen von. Dr. L. R. Schulze. 8vo. Leipzig, 1873.

Rede in der offentlichen Sitzung der k. Akademie der Wissenschaften am 25. Juli 1873. Zur Vorfeier des Allerhochsten Geburtsfestes Sr. Majestat des Konigs Ludwig ii. J. von Dollinger. 4to. Munchen, 1873.

Der Antheil der k. bayerischen Akademie der Wissenschaften an der Entwickelung der Electricitatolehre. Vortrag in der offentlichen Sitzung der k. Akademie der Wissenchaften am 25. Juli 1873. Zur Vorfeier des allerhochsten Geburts-und Namensfestes Sr. Majestat des Konigs Ludwig ii, gehalten von W. Beetz ordenti. Mitglied der mathem. physik. Classe 4to. Munchen 1873.

Oversigt over det Kongelige Danske Videnskabernes Selskabs Forhandlinger og dets Medlemmers Arbejder i Aaret 1873. Med 2 Tavler og med Bilag samt med en Resume du Bulletin de l'Academie Royale Danoise des Sciences et des Lettres. 8vo., No. i. Jan.-March. Kjobenhavn.

Sitzungsberichte der philosophisch-philologischen und historischen Classe der k. b. Akademie der Wissenschaften zu Munchen. 8vo., sig. 27, 1871. Heft iv-vi, 1872. Heft i-v, 1873. Heft 1-4. Munchen.

Sitzungsberichte der mathematische-physikalischen Classe der k. b. Akademie der Wissenschaften zu Munchen. 8vo, sig. 15, 1871. Heft iii, 1872. Heft 1-3, 1873. Heft. i, ii. Munchen.

Proceedings of the Boston Society of Natural History. 8vo. Vol. xvi, Part ii. June, 1873-Jan. 1874. Boston, 1874.

Report on the Birds of Minnesota. By P. L. Hatch, M.D. 8vo.

Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, Mass. 8vo, Vol. iii, No. 9. *Catalogue of the Terrestrial Air-breathing Mollusks of North America.* By W. G. Binney. Cambridge, 1874.

Vol. iii, No. 10, 7 plates. *Ophiuridæ and Astrophytidæ, New and Old.* By Theodore Lyman. Cambridge, 1874.

Geological Magazine. New Series. 8vo. Decade ii. Vol. i, Nos. 2, 3. Feb. and March, 1874. London.

Proceedings of the Academy of Natural Sciences of Philadelphia. 8vo, pp. 9-24. 1874.

Bulletin of the Buffalo Society of Natural Sciences. 8vo. Vol. i, No. 4. 1874.

Report of the Entomological Society of the Province of Ontario for 1873. 8vo. Toronto, 1874.

Bulletin de l' Institute National Genevois. 8vo, tome xviii. Geneve, 1873.

Societe Entomologique de Belgique. 8vo, No. 97. 1874.

Berichte uber die Verhandlungen der Koniglich Sachsischen Gesellschaft der Wissenschaften zu Leipzig. Mathematisch-Physische Classe. 8vo. 1868 to 1873 incl. Parts i and ii. Leipzig.

Report on the Condition of the Sea Fisheries of the South Coast of New England in 1871-1872. With plates. By S. F. Baird. U. S. Commission of Fish and Fisheries. Washington, 1873.

Annales de la Societe Malacologique de Belgique. 8vo. Tome vi, vii, 1871-1872. With plates. Bruxelles, 1873.

Proces-Verbaux des Seances de la Societe Malacologique de Belgique. 8vo. Tome ii. Bruxelles, 1873.